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ABSTRACT

This practicum was designed and implemented to instruct the staff of two elementary schools in the basic content of the metric system and to demonstrate some teaching strategies for instructing elementary students in metrics. A series of twenty after-school workshops was run on a weekly basis. A model was developed to aid other elementary schools within the district in planning in-service workshops on the metric system. Appendices include the workshop agenda, pre- and post-test scores of students, elementary teachers' survey, samples of learning activities, and a list of metric materials. (Author)

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IMPLEMENTING THE METRIC SYSTEM:

GRADES K-6

By

Joseph A. Wright

Submitted in partial fulfillment of the requirements

for the

National Ed. D. Program for Educational Leaders

Nova University

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Abstract:

This practicum was designed and implemented to instruct the staff of two elementary schools in the basic content of the metric system and to demonstrate some teaching strategies for instructing elementary students in metrics. A series of twenty after-school workshops was run on a weekly basis. A model was developed to aid other elementary schools within the district in planning in-service workshops on the metric system. Appendixes include the workshop agenda, pre-and post-test scores of students, elementary teachers' survey, samples of learning activities, and a list of metric materials.

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CHAPTER I

Background

On December 23, 1975 President Ford signed the "Metric Conversion Act of 1975." Section 3 of this Act states, "It is therefore declared that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system."[1]

A 30-member New York State Educators Metric Advisory Committee was appointed by Commissioner Ewald Nyquist to assist him and the Department in planning and guiding this state's metric education activities.

The time has arrived for all New York State educators to start putting their "measurement house" in order, in the opinion of the State Education Department's Metric Committee. "In reality, the entire United States measurement house, as it now stands, is rather rambling and untidy," claim the members of this Committee.

A policy statement on Metric Education was sent to all schools in New York State in January,1975 proposing "a carefully planned and

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[1] Public Law 94-168, 94 Congress H.E. 8674, December 23, 1975.

coordinated changeover to metrics in the instructional program of the schools of the state." (Appendix 1.) The statement recommended that by the 1979-80 school year, metric measurement become the predominant measuring system in our schools.

Realizing the challenge put before the educational community by the Metric Conversion Act of 1975 and the New York State Education Department, this practicum was developed and implemented. Its major purpose was to prepare teachers to instruct students to understand and use the metric system with ease and facility.

Two elementary schools were involved in this practicum: Jackson Main and Ludlum Elementary School in the Village of Hempstead.

The Village of Hempstead in Hempstead, New York is situated in the middle of Nassau County.

The population of the village reflects an ethnic make-up of eighty-seven per cent Black, eight per cent White, and four per cent Hispanic. The remaining one per cent is a mixture of other ethnic groups.

While Hempstead has some large estates, the median average income of the Village of Hempstead is $14,988. This is lower than the median income of the surrounding communities.[2]

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[2]1970 Census Data, (Hempstead, N.Y.: Hempstead Urban Renewal Agency, 1974.)

A very small percentage of the children is economically disadvantaged. Of the 5,000 students who attend the public schools, only ten per cent receive the Aid to Dependent Children (ADC).

A large percentage of the school population represents students from middle and upper middle class homes immediately surrounding the schools.

The school district consists of eight elementary schools, a Middle school, and a High school. Hofstra University is also located in the Village of Hempstead.

CHAPTER II

STATISTICAL DATA JUSTIFYING NEEDS

Needs Analysis

The State of New York Bureau of Mathematics Education recommended to the Hempstead School District that schools should begin teaching metric measurement as soon as students learn a standard measurement system.

The fall of 1979 was established by the State Education Department as the target date when the measurement strand on the K-6 Mathematics syllabus was to become predominately metric. (Appendix 2.)

Adoption of the metric system (IS System) in the public schools of Hempstead, New York instituted a period of transition and adjustment. During this period (1977-78), the teachers in the target schools covered by this practicum had indicated in informal group discussions that they were unable either to teach students or to familiarize them with metric units of measurement.

A statistical survey was carried out in Jackson Main and Ludlum Elementary Schools in the Hempstead School District during the 1978 school year.

The survey of thirty-two elementary teachers in the target schools was designed to determine their knowledge of and skills with the metric system.

Table I

ELEMENTARY TEACHERS SURVEY

Number of teachers in survey	Number of teachers attending metric workshops prior to 1978	Percent
32	2	6
Number of teachers in survey	Number of teachers having metric experience prior to 1978	Percent
32	3	9

All teachers taught mathematics, and from the returns it was evident that ninety-one per cent of the staff in the target schools had very little or no previous knowledge of the metric system.

The survey showed that two teachers, or six per cent, had attended a metric in-service workshop prior to 1978. Three teachers, or nine per cent, had had metric experience before this practicum was implemented.

Statistical data also contained in Appendix 3 show that a significant number of teachers had limited background in mathematics training, and little or no experience in the area of metrics.

In addition to the survey conducted, teachers in the target schools of this practicum were observed by the District's Mathematics Coordinator, Building Principals, and the Assistant Superintendent for Curriculum and Instruction. The observations also focused on involvement with the metric system.

A classroom observation checklist was developed and used to describe the teachers' classroom behavior.

Table II

CLASSROOM OBSERVATION SURVEY

Observation Elements	Number of Teachers	Percentage
Outstanding	8 out of 32	25
Satisfactory	2 out of 32	6
Requires Improvement	22 out of 32	69
Unsatisfactory	0 out of 32	0

Observation of skills and concepts taught in the measurement strands indicated that twenty-two,or sixty-nine per cent of those teachers had problems with basic mathematics concepts.

The results of the observations showed that basic mathematics instruction at the elementary level did not include materials and activities which helped students learn the nature of numbers and other mathematical concepts. The instruction also did not encourage students to develop their problem-solving and abstraction abilities. It was rigid in format and limited in scope and variety, and dominated by the pencil, paper, and ditto approach. Therefore, to introduce this group

of teachers to the metric system, it became necessary to introduce a wider variety of instructional modes and metric materials to the teachers in the target schools to upgrade their teaching performance in measurement.

Principals, during their observations of teachers, saw a definite need for in-service training in the area of metrics to meet the mandate of the State Education Department.

Students' Needs

An evaluation was made of third and sixth grades, through use of metric tests (Hempstead Basic Test of Metrics at the third grade level[3] and the Bitter Mastery Test at the Sixth grade level[4]), to determine their knowledge and skills in the area of metrics.

Statistical data was gathered from the pre-test administered to one hundred sixty-three students who comprised the target population.

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[3] Hempstead Basic Test of Metrics--Curriculum Management System. Hempstead Public Schools, Hempstead, New York, 1978.

[4] Bitter, Gary G. Activities Handbook for Teaching of Metric System. Allyn and Bacon, 1976, pp. 330-336.

Table III

Hempstead Basic Test of Metrics
Third Grade

Pre-Test

Category	Number of Students	Mastery Level	Per cent	
			Pre-Test 1978	Post-Test 1979
Average	71	35 out of 50	0	
Above Average	5	40 out of 50	0	
Superior	2	45 out of 50	0	

The Hempstead Basic Test of Metrics pre-test showed statistical evidence that the students in the third grade were unsuccessful in achieving the mastery level on the items tested in September 1978.

Table IV

Bitter's Mastery Test
Sixth Grade

Pre-Test

Category	Number of Students	Mastery Level	Per cent	
			Pre-Test 1978	Post-Test 1979
Average	72	12 out of 18	0	
Above Average	12	14 out of 18	0	
Superior	1	16 out of 18	0	

The Bitter's Mastery pre-test showed statistical evidence that the students in the sixth grade were unsuccessful in achieving the mastery level on the items tested in September 1978.

Statistical evidence contained in appendixes 4 - 5 discloses significant evidence of students in the target schools performing below their expected performance level on the Hempstead Basic Test of Metrics and the Bitter's Mastery Test, although their intelligence quotient (I.Q.'s) had placed them in the average, above average, and superior range category on the Otis-Lennon Mental Ability Test.[5]

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[5] Otis, Arthur S., and Lennon, Roger T. Otis Lennon Mental Ability Test. Harcourt Brace Jovanovich, Inc., 1968.

This revelation would naturally be the concern of the practicum coordinator working with teachers and students at the elementary level. How could these students' performance be upgraded? The teacher's competence in the area of metric instruction was addressed in search of any solution to this problem. Any means which made for improving the students' performance and teachers' competence, including that of a practicum utilized in this situation, would be worthwhile investigating.

Statement of Needs Analysis

From a review of the documentation offered, it was apparent to the participant of this practicum that there was a need for a metric program directed toward a particular group of students and teachers who needed to master metrication.

In order for the Hempstead School District to be prepared to meet the New York State mandate for teaching the metric system in the elementary schools, there was a need for the district to develop and implement intensive metric in-service workshops coupled with classroom demonstrations for teachers to begin both to learn and to teach the metric system to students effectively.

CHAPTER III

TERMINAL OBJECTIVES TO IMPLEMENT THE METRIC SYSTEM: GRADES K-6

Based on the needs analysis presented in Chapter II, a set of terminal objectives was established for the academic year 1978-79. Achieving these objectives resulted from the model program entitled "Implementing the Metric System: Grades K-6."

The objectives were:

1. All third graders of average ability on the Otis-Lennon Mental Ability Test (seventy-one students) who scored below the nineteenth percentile on the Hempstead Mastery pre-test in September, 1978 should score at thirty-five, or 70 per cent on the post-test.
2. All third graders of above average ability on the Otis-Lennon Mental Ability Test (five students) who scored below the nineteenth percentile on the Hempstead Mastery pre-test in September, 1978 should score at forty, or 80 per cent on the post-test.

3. All third graders of superior ability on the Otis-Lennon Mental Ability Test (two students) who scored below the nineteenth percentile on the Hempstead Mastery pre-test in September, 1978 should score at forty-five, or 90 per cent on the post-test.
4. All sixth graders of average ability on the Otis-Lennon Mental Ability Test (seventy-two students) who scored below the nineteenth percentile on the Bitter's Mastery pre-test in September, 1978 should score at twelve, or 67 per cent on the post-test.
5. All sixth graders of above average ability on the Otis-Lennon Mental Ability Test (twelve students) who scored below the nineteenth percentile on the Bitter's Mastery pre-test in September, 1978 should score at fourteen, or 78 per cent on the post-test.
6. The sixth grader of superior ability on the Otis-Lennon Mental Ability Test (one student) who scored below the nineteenth percentile on the Bitter's Mastery pre-test in September, 1978 should score at sixteen, or 89 per cent on the post-test.

7. Participating teachers should increase their knowledge and experience with regard to skills in the area of metrics, and utilize these skills at the level of "Very good" or "Excellent" in the classroom following the in-service workshops.

CHAPTER IV

RESEARCHING THE STRATEGY

In order to get aid in formulating a strategy for implementing the metric system in grades K-6, it was necessary to examine the literature on this topic. A search was initiated through the Board of Cooperative Educational Services ERIC System. The readings and findings resulting from this search are reflected in this practicum and documented in the bibliography. Some of the appendixes are actual outlines of specific programs and are offered as part of the research effort.

Additional research was done through school visitation to other districts that have recently changed their measurement strands to include metric units.

Related Literature, Research Reports, and Programs

The National Education Association believes that a carefully-planned effort to convert to the metric system is essential to the future of American industrial and technological development and to the evolution of effective world communication. It supports federal legislation that would facilitate such a conversion.

The Association declares that, commencing with the 1971-72 school year, teachers of all grades should teach the metric system as the primary system of weights and measures of the United States.[6]

The United States Metric Study Interim Report on Education, which is one of the most comprehensive reports available, makes recommendations in two areas that are of particular interest to this practicum.[7] First, it recommends that a switch to the metric system be accompanied by a major revision of the elementary school curriculum, a revision comparable in scope to the curriculum changes of the early 1960's. The new curriculum should emphasize decimal fractions and present the metric system in a context that provides active participation in measurement activities. Secondly, the report recommends that in-service training for going metric be condensed into a short period of time (from eight to fifteen hours) just before the teachers begin to teach the metric system. Because teachers generally teach as they are taught, the training should be similar to that which they will use with their students.

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[6]The NEA Research Bulletin. Think Metric. May 1971. P. 40

[7]U.S. Metric Study Interim Report: Education, National Bureau of Standards Special Publication 345-6. Washington, D.C.: U.S. Department of Commerce, 1971.

In the May-June 1975 issue of Illinois Teacher of Home Economics, Judy Oppert[8], a recognized authority on metrics, wrote an article entitled "Principles for Teaching Metrics." The principles were developed to aid teachers in presenting the metric system to students, and had been gathered from the author's experience and the writings of many people who taught or studied the teaching of the metric system in other countries as well as in the United States. This article was carefully studied, and phases were adopted and used in the implementation of this practicum.

The New York State Education Department's publication, "The Metric System",[9] suggested that any school system deciding to begin metric instruction should plan carefully and contemplate five phases to go through in changing to metrics:

Phase I	-	Awareness
Phase II	-	Knowledge (information gathering)
Phase III	-	Comprehension
Phase IV	-	Application
Phase V	-	Commitment (adoption)

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[8]Oppert, Judy. "The Home Economics Teacher and Metrics". Illinois Teacher of Home Economics, Vol. 18, pp. 331-347, 1975.

[9]Negus, LeRoy. The Metric System. The State Education Department Bureau of General Education Curriculum Development, Albany, N.Y. 12234, 1976.

Great Neck, Union Free School District (U.F.S.D. #7), conducted a Cooperative Area Program (CAP) Summer 1974 workshop entitled "The International Units of Measurement and the Metric System--Exploration and Implementation." The purposes were to develop a structure and time schedule for the implementation of metrication in the schools and community of Great Neck, to set up a series of recommendations that would facilitate implementation of metrication, to establish a broad outline of a K-12 metric curriculum, and to develop a set of guidelines for in-service courses geared to specific groups of teachers who needed to master metrication.[10]

New York State has one validated Title IV-C demonstration project in metric education. Twenty-three school districts are replicating Pearl River's Project Measure.[11] Project Measure is a metric program including objectives, activities, tests, and recommended materials. It has been validated for grades 1-4, and work is continuing on grades 5 and 6. (Appendix 6.).

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[10] The International Units of Measurement and the Metric System--Exploration and Implementation. Great Neck Public Schools, Great Neck, New York, 1974.

[11] Project Measure, Pearl River School District, Pearl River, New York, 1978.

Federal funds have been used to develop metric projects in other states, also. The following three projects were worth contacting to study the curriculum materials and metric activities.

Elementary Metric Project[12] of Bismarck, North Dakota, has been validated for the National Diffusion Network (NDN). The project includes a teacher in-service component and sequential curriculum for grades 1-6.

The project has been validated by the joint Dissemination Review Panel and selected by the United States Office of Education for the National Diffusion. (Appendix 7).

Project Metric[13] of Wayne-Westland, Michigan, includes a large number of booklets featuring various games and activities for teaching the metric system. Activities are available for elementary students right on up to parents and community members. (Appendix 8).

Winston-Salem/Forsyth County Schools Metric Education Project[14] of Winston-Salem, North Carolina, has developed a complete metric education project, from planning to teacher in-service education to

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[12] Elementary Metric Project, Bismarck Public Schools, "Think Metric", Bismarck, North Dakota, 1976.

[13] Project Metric, Wayne-Westland Community Schools, Westland, Michigan, 1978.

[14] Metrics In The K-8 Curriculum, A Multidisciplinary Guide to Transition. Winston-Salem/Forsyth County School System, North Carolina Department of Public Instruction, 1976.

curriculum materials. The Project booklet, "Metrics in the K-8 Curriculum", cross-references objectives by grade level with metric materials.

This project has numerous instructional materials appropriate for use at the elementary level.

The programs were studied from two perspectives. One included the ability of the program to meet the needs of the schools involved in the practicum, the other focused on their ability to fulfill the said needs. In addition, the programs were grouped into two types.

I. Type A--Teacher Training Programs in Metrics.

These programs were designed to help classroom teachers improve upon their skills in metric measurement teaching.

II. Type B--Replication Programs.

These Metric Programs were developed by local school districts and validated by the State Education Department Review Panel. These programs were to be replicated in other school districts looking for improved ways to solve their educational problems.

Type A Program

An educational agency in New York which typifies Type A programs is the Great Neck, Union Free School District #7 program, "The International Units of Measurement and the Metric System--Exploration and Implementation."

To utilize such a program, Hempstead Public Schools would employ one of Great Neck's consultants to conduct in-service workshops at a Hempstead site for eight full days, or thirty-two two-hour sessions. The district would pay the cost of the consultant and each of the participants.

Paying the expense for those participating in the in-service workshop would therefore necessitate an increase in the general budget of the school district. Financing such a program has been unacceptable to the Superintendent of Schools, among whose major concerns is that of keeping the district's budget cost down.

Without the necessary monetary reimbursement to the consultant and the staff participating, the district cannot afford to adopt this type of program.

Type B Program

Type B programs are exemplified by Pearl River's Project Measure, which is a New York State replication program.

The school district which develops such a program is provided with Elementary, Secondary Educational Act Title IV-C (ESEA) funds

to cover the cost of dissemination and demonstration of activities. More specifically, funds are used to select and train potential replicators (those adopting the said program), to provide technical assistance during the process of adoption, and to provide follow-up and evaluation services to the replicator.

To replicate a Title IV-C program in New York State, the replicating district must apply for IV-C funds. These are sums which have accrued to the state, and are available to districts on a competitive basis for short-term special projects. Unfortunately, the state does not permit the addition of these funds to the regular yearly district allocation.

In most instances these in-service education programs require a number of workshops. This requirement is rarely met. In addition, there is frequently a lack of preparation for or follow-up on the workshops given. The content of these workshops, which is extremely necessary, is often not based on or related to the teachers' ability to absorb or utilize the experience.

The major difference between a Type A and a Type B program is that Type A seeks to improve the classroom teacher's skills and knowledge in metrics, while Type B places emphasis on replicating methods and meterials to solve metric educational problems.

Strategy Selected

In order to meet the critical needs described earlier, the practicum coordinator strongly felt that an in-service program coupled with classroom demonstrations, both comprehensive and sustained, should be developed.

Based on the research and comparative studies done on the various types of programs designed to implement metric instruction in the elementary school, the strategy which was most satisfying and effective in meeting the common need of the two schools was one formulated by utilizing a number of the concepts and ideas from both the A and B type programs. No single program, neither A nor B,was the answer. Therefore, it became advantageous to develop and implement an individualized in-service program witnin the district.

The practicum coordinator had a unique role in the development and implementation of the metric program because of his District Central Office position as the Mathematics Coordinator. It was his decision that it was too costly and time consuming to "re-invent the wheel", i.e.,to adopt the type A or type B programs. Therefore, after a great deal of time and study on the part of the practicum coordinator, it was decided to adopt concepts and ideas from those suggested by the United States Metric Study, to revise the measurement strands in the elementary curriculum, and to provide in-service workshops for going metric condensed into short periods of time just before the teacher began to teach the metric system.

Judy Oppert's "Principles for Teaching Metrics" were utilized in this practicum. These principles were used to help teachers to learn the metric system.

It was necessary to convince teachers that the metric system is useful, important, and worth learning before convincing students that the metric system is a useful measurement system.

Great Neck's structure and time schedule for the implementation of metrication in the schools and community was reordered and rewritten to fit the needs of the target schools.

The in-service component utilized in the elementary metric project of Bismarck, North Dakota was reworked until a mutually acceptable component was developed for the two schools involved in this practicum.

The Curriculum strategies utilized were adopted from the Winston-Salem/Forsyth County Schools.

Focusing attention on in-service workshops and classroom demonstrations to implement metric education in the schools would permit the involvement and interaction of pupils, teachers, and administrators. The program would be planned and carried out to work directly with teachers in such a way as to raise their skills in teaching metrics.

The Hempstead District itself was fully equipped to meet the responsibility with regard to the training of teachers in the metric system. The District offered the following advantages. The Practicum Coordinator had knowledge of the elementary mathematics curricula, teaching methods and materials, and extensive experience in directing in-service programs.

Since the Practicum Coordinator qualified to conduct the in-service workshops, consultants from outside the system were not necessary.

There was no cost for materials. The two schools had materials for the project, materials which had been acquired with funds from a Title I "Reallocated" Grant and from the New York State Chapter 241 Pupils with Special Educational Needs Program (PSEN).

In light of the comparative studies, it was the recommendation of the practicum coordinator that significant improvement in metric instruction would occur when the in-service training was given in schools with the target population. The following are the significant features of the in-service program.

I. Thirty-two teachers were involved in the in-service workshops and classroom demonstrations.

II. All classroom teachers in the target schools participated. Some taught mathematics in a departmentalized situation, while others were teachers in self-contained classrooms.

III. These in-service workshops and classroom demonstrations were conducted by the Practicum Coordinator.

IV. Each classroom demonstration involved forty-five minutes of class time per week.

V. At least one teacher was available to observe the Practicum Coordinator giving classroom demonstrations. The teacher continued in future math classes to utilize the techniques and content material observed in the demonstration.

VI. The in-service program focused on grades K-6 with special emphasis on grades 3 and 6, since these are the grades in which New York State gives the Pupil Evaluation Program Test (PEP Test).

VII. At the end of the instructional day, the Practicum Coordinator held teacher workshops as follows:

Group A: All Kindergarten, First, Second, and Third grade teachers for one hour.

Group B: All Fourth, Fifth, and Sixth grade teachers for one hour.

VIII. Teachers attended the metric in-service workshop on the day the Practicum Coordinator worked in their classroom with students.

IX. Teacher training sessions were held at 2:45 p.m. in the two schools for both A and B groups on alternate weeks throughout the 1978-79 school year. The sessions were held during the period from September to June. (Appendix 9).

X. The program provided for the Practicum Coordinator to visit each of the schools twice a week on a rotating basis.

XI. From the point of view of teachers' schedules, the program required no additional procedures. It was part of the regular school day.

XII. Building Principals met with the Practicum Coordinator and the A Group once a month at 2:45 p.m.

The Practicum Coordinator, Building Principals, and Teachers expended a year-long, continuous effort to assess students' performance in metrics and to provide intervention when required.

Because this practicum encompassed two schools, periodic meetings were held with Building Principals, the Assistant Superintendent of Schools, and the Practicum Coordinator to deal with the various problems confronting each school. Approaches and solutions were worked out at these meetings. The cumulative experience of these meetings was used in addressing the problems of each school.

At the beginning of this practicum, the Practicum Coordinator provided in-service training in the following areas:

A. Nature of the program - 1. Objectives

2. Role definition of each participant

B. Strategies to assist each teacher and student through the program.

In addition to implementing the metric program at the two schools, there were supportive elements in the program:

(a) Each school Media Center had an exhibit of reference materials on metrication;

(b) Each school (Ludlum and Jackson) had a "Metric Day". In all classrooms large-group activities were designed to promote metric understanding;

(c) Open-School Nights featured metric posters, classroom displays and presentations that included substantial evidence of the impact of metrication;

(d) School health personnel, particularly school nurse-teachers, recorded pupil records indicating killogram weights, Celsius temperature, and metric height units;

(e) Each classroom in the two schools had its metric dimensions posted. Student exposure to metric information was maximized wherever possible;

(f) The cooperation of the physical education staff was enlisted in moving toward the earliest possible conversion to metric units of measurements used in the athletic competitions;

(g) The District Curriculum Materials Center was used for the purpose of planning, developing, and disseminating information, displays, references, and special teaching devices for use in the schools. The Center contained an extensive collection of metric hardware and software, including catalogued listing of sources and cost. This material was arranged in a manner suitable for faculty examination and evaluation for possible use.

CHAPTER V

Process Objectives

In order to attain the terminal objectives of the metric in-service program designed to implement metric education in the elementary schools, the following process objectives were set:

I. To establish a metric in-service program coupled with classroom demonstrations in two schools (20 sessions in each school)
   A. Jackson Main, with fifteen teachers
   B. Ludlum Elementary School, with seventeen teachers.

II. To assist participating teachers to attain the goals of the program, the Practicum Coordinator established in each school an orientation session for all instructional and support staff members which provided training in the following areas;
   A. The nature of the program
   B. Objectives of the program
   C. Role definitions

III. To assist teachers to understand the intervention procedures employed in the program to implement metric education, the following metric in-service workshops were held

A. Training techniques for classroom teachers

B. Classroom demonstrations

In order to achieve the terminal objectives of the program the process objectives were accomplished in the following manner.

The Practicum Coordinator submitted to the Assistant Superintendent for Curriculum and Instruction a request for approval of the project. In the request, the items listed below were to be approved:

I. Practicum Coordinator to implement and conduct the project;

II. The content of the workshops;

III. Selection of Jackson Main and Ludlum as the sites for the project;

IV. Target population for the project;

V. The exact number of in-service credits for each participant;

VI. Teacher schedules for metric demonstrations.

An orientation meeting was held at each school in September. Where possible the two Principals met with the Assistant Superintendent, who was the liaison person. The orientation sessions fell into two natural divisions.

First, a lengthy presentation was made by the Coordinator stressing the points outlined in the Practicum Strategy. The Assistant Superintendent then followed with the requirements for in-service credit as outlined in Appendix 10.

In each school, teachers were very concerned about how they would function in the program. At Ludlum, the question of additional reimbursement arose for the extra work that the program entailed. At Jackson Main, the question of accountability arose. Staff members were reassured that they would not be held accountable beyond the normal standards set for the district. The nature of the orientation program answered this problem.

Roles of the Participants

Once the broad picture of the program was presented, the role of each participant was outlined.

The Practicum Coordinator's role was seen as one providing orientation to staff, conducting the workshops for teachers, and doing demonstration lessons with students in the classrooms as teachers observed. He was the person directly responsible to the principals for the implementation of the program of metric education in the elementary schools.

The Assistant Superintendent was to be the resource person responsible for orientation of all administrators, parents, and concerned residents of the community. He also verified in-service credits.

Teachers were expected to observe demonstrations and attend in-service workshops to acquire the ability to articulate metric concepts in accurate and precise terms. In addition, they were expected to improve their selectivity and utilization of metric materials so as to provide maximum benefit to the student.Finally, as a result of clear understanding of the subject, they were to transmit their new learning more effectively to students.

The principals were to function in their usual manner, but with the added insights into the nature and objectives of the in-service program. Close lines of communication were to exist between the practicum coordinator and the principals to obviate problems inherent in the new program.

A great deal of exchange took place during the session that dealt with specific roles within the program as they related to each workshop participant. There was general agreement that if the program were to be successful, it was absolutely necessary for each participant to know and understand his role clearly.

Facts of the Program

At each in-service workshop a number of steps were presented by the practicum coordinator to assist teachers with students experiencing difficulties. Additional input from members of the workshop was also accepted.

The first step was to spend time in each school talking with the selected staff members about the content to be dealt with for

the year, their methods of teaching measurement, the materials that they had available for use, and their needs as they saw them.

The second step was to seek input from principals and the Mathematics Specialist in each building. As a result of their information, materials and resources were researched and selected appropriate to the content to be covered, the teachers' ability or preparedness to deal with the said content, and the students' level of comprehension.

The third step dealt with setting up regular schedules with the staff. This schedule included a visit from the practicum coordinator at least twice a week to the teacher's classroom during the teaching of mathematics. One planning session per week per staff member was also scheduled.

The fourth step to assist the classroom teacher was that of arranging and implementing units of metric instruction. The units of instruction were those that had been previously designated for the year. The practicum coordinator discussed the plans with the teacher on a regular basis, provided help when the teacher requested it, and made suggestions on teaching methods and materials.

The fifth step included giving a series of twenty workshops for the entire staff at each of the two schools. Workshops were held on a bi-weekly basis for each group. While it was found necessary to modify and to discuss topics and issues related directly or indirectly to each week's instruction, there was major concentration on the following topics:

I. Mass (weight)

II. Length

III. Area

IV. Volume

V. Temperature

These topics were covered in the in-service workshops throughout the year, with specific objectives to implement metric instruction. A detailed account of the workshops may be found in appendix 11.

The sixth step was for the practicum coordinator to conduct classroom demonstrations to assist students in increasing their abilities to perform various kinds of metric conceptual operations even when the complexity of the metric operation increased.

In order to utilize in the classroom the methods and materials introduced at the in-service workshops, as well as to provide for standardization among teachers, the practicum coordinator conducted one demonstration lesson each week in classrooms participating in the practicum. A major advantage resulting from the demonstration lesson was that teachers had an opportunity to observe firsthand the effectiveness of the methods.

Informing teachers of the nature and merits of the classroom demonstrations was achieved partly through staff meetings held in each school, and later as a result of the teachers' actual participation in the demonstrations. At the in-service sessions written information was circulated which explained in detail the format of

the workshop as it related to objectives, selected activities and evaluation.

In addition, each session included a description of the classroom demonstration, the content of which was based on the plans established by the district. This demonstrated a dual advantage in that teachers were not only informed of the high quality of instruction expected of the program, but were also given the assurance that no drastic change or interference punitive in nature would be forced upon them.

Instruction in measurement progressed through four stages of development; the first stage was direct comparison between objects in the environment. During the second stage, objects in the environment and parts of the body were used as units of measure. By the time students reached the third stage, they had gained concepts of the different units of measure and were ready to use the metric units. In the final stage, the children learned to select standard units of appropriate size for measure involving specific tasks.

The learning processes that were identified by the practicum coordinator as important for the children's conceptual growth in measurement included:

I. Language development

II. Estimation

III. Matching and comparison

IV. Ordering

V. Relations and mapping

VI. Pictorial representation

Decisions about the grade placement of a particular measurement activity in the teaching strategy were made in relation to the child's ability determined by the teachers and practicum coordinator.

CHAPTER VI

Evaluation of the Program to Implement the Metric System : Grades K-6

Evaluation of Terminal Objectives

In each school, the following factors were used to control the variables considered in determining the fulfillment of the terminal objectives of the program to implement the Metric System in Grades K-6.

I. Students in each school selected demonstrated severe basic skills deficiencies in metrics as shown in the Hempstead Metric Test at the third grade level and the Bitter's Mastery Test at the sixth grade level.

II. In each school the target population selected was composed of students who were of average, above average, and superior caliber.

III. In each school the teachers who taught elementary mathematics in the non-intervention year 1977-78 were the same teachers for the intervention year 1978-79.

IV. Teachers in each school were taught the same pre-requisite skills in methods and materials to be implemented in their classroom.

V. The metric strands in the mathematics syllabus were the same in each school.

The fundamental difference between the non-intervention year 1977-78 and the intervention year 1978-79 was the practicum to implement the metric system in grades K-6.

The criterion used in the evaluation of the program was a statistical comparison of the non-intervention year 1977-78 with the results of the intervention year 1978-79 for two schools involved in the practicum.

On the Hempstead's Basic Metric Test of June 1979, third graders were regarded as totally successful when the students of average ability scored at thirty five, or 70 per cent, the students of above average ability scored at forty, or 80 per cent, and the students of superior average ability scored at forty five, or 90 per cent.

Table V

Hempstead Basic Metric Test

Third Grade

Post-Test

Category	Number of Successful Students	Mastery Level	Per cent	
			1978 Pre-Test	1979 Post-Test
Average	69	35 out of 50	0	97
Above average	5	40 out of 50	0	100
Superior	1	45 out of 50	0	50

The Hempstead Basic Metric Test post-test showed statistical evidence that in the third grade 97 per cent, or 69 students, in the average category were successful in achieving the mastery level. The above average category showed that 100 per cent, or 5 students, were successful in achieving their mastery level, and 50 per cent, or 1 student, was successful in achieving the mastery level in the superior average category.

On the Bitter's Mastery Test of June 1979, sixth graders were regarded as totally successful when the students of average ability scored at 12, or 67 per cent, the students of above average ability scored at 14, or 78 per cent, and the students of superior average ability scored at 16, or 89 per cent.

Table VI

Bitter's Mastery Test
Sixth Grade
Post-Test

Category	Number of Successful Students	Mastery Level	Per cent	
			1978 Pre-Test	1979 Post-Test
Average	66	12 out of 18	0	97
Above Average	10	14 out of 18	0	83
Superior	1	16 out of 18	0	100

The Bitter's Mastery Test post test showed significant statistical evidence that in the sixth grade 97 per cent, or 66 students, in the average category were successful in achieving the mastery level. The above average category showed 83 per cent,or 10 students, were successful in achieving their mastery level, and 100 per cent,or 1 student, was successful in achieving the mastery level in the superior average category.

A classroom observation checklist used by the practicum coordinator to determine the degree to which the in-service workshop skills were utilized in the classroom is presented below. The items were rated on a scale of good to excellent. Each of the skills the teachers was expected to display is designated in the left hand column. Under each rating is the percentage of each item as rated by the coordinator.

Table VII

Classroom Observation Checklist

Skills	Rating Scale: Good	Very Good	Excellent
1. Quality of teacher/pupil interaction		75%	25%
2. Use of Audio-visual media in metrics		90%	10%

Table VII (continued)

Classroom Observation Checklist

Skills	Rating Scale		
	Good	Very Good	Excellent
3. Use of manipulative aids in metrics		70%	30%
4. Use of small groups in working situations	5%	70%	25%
5. Opportunities for independent metric projects and experiments	12%	80%	8%
6. Use of activity-centered metric instruction		7%	93%
7. Teacher's confidence with metric lessons		75%	25%
8. Sensitivity to individual abilities, needs, and interests		25%	75%
9. Planning and preparation of metric lessons		15%	85%
10. Extent metric program is integrated with other subjects	30%	70%	

The results of this checklist clearly indicate that the in-service workshops and their objectives were successfully met, and that the strategies of the program were understood.

The data presented above attest to the success of the program to implement the metric system in grades K-6. Both schools attained their objectives and were within the range of one hundred per cent success rate. The program can, therefore, be said to have been successfully implemented.

The first process objective was to implement an in-service program coupled with classroom demonstrations directed at implementing the metric system in grades K-6 in the Jackson Main and Ludlum Elementary schools. Confirmation that this in-service program was established is contained in appendix 12 .

The second process objective of the program to implement the metric system in grades K-6 required that in-service workshops be held to orient teachers in the following areas:

I. Nature and objectives of the program;

II. Role definitions of each participant;

III. Strategies to assist teachers in the subject.

Each teacher in the program was asked to respond to a questionnaire evaluating the in-service workshops. The items that follow were to be rated on a scale of 1 (excellent) to 5 (poor). The responses to the questionnaire will follow the chart.

Each school is designated in the right hand column. Under each school is the evaluative average of each item.

Table VIII

IN-SERVICE WORKSHOP QUESTIONNAIRE

The following questions pertain to the Metric In-Service Program. Please indicate your response based on the scale below by placing the corresponding number in the right hand column.

1. Excellent
2. Very Good
3. Average
4. Below Average
5. Poor

	JACKSON MAIN	LUDLUM
1. Did the in-service program clearly delineate the nature of the metric materials and techniques to be used in the classroom?	1. 1	1
2. Did you clearly understand the objectives for third grade students scoring below expectancy level on the Hempstead Basic Metric Test?	2. 1	1
3. Did you clearly understand the objectives for sixth grade students scoring below expectancy level on the Bitter's Mastery Test?	3. 1	1
4. Did you clearly understand the use of the Metric Lab materials used for the in-service training session?	4. 1	1
5. Did you clearly understand the role of the coordinator in the program?	5. 1	1
6. Did you clearly understand the strategy for assisting students using Metric materials?	6. 1	1

Table VIII (continued)

IN-SERVICE WORKSHOP QUESTIONNAIRE

1. Excellent
2. Very Good
3. Average
4. Below Average
5. Poor

		JACKSON MAIN	LUDLUM
7.	Was the atmosphere of the in-service program conducive to implementing the Metric Program?	1	1
8.	I am pleased to have been selected to participate in the Metric In-Service Workshop.	1	2
9.	Participating in the Metric In-Service Program helped me improve my knowledge and understanding of the metric system and the sequence of teaching metric education.	1	1
10.	Did the program give you a better understanding of your students' needs?	1	1
11.	Considering the effort you put forth, was it worth having such a program?	1	1

Regarding the nature of the Metric Program, both schools received "excellent" in Question 1. Two main objectives of the program in Question 2, and 3, received an "excellent" rating in Question 5 the role of the coordinator was clearly understood. The use of Metric Lab materials had a high rating,"excellent" in Question 6.

Questions 9, 10, and 11 attained an "excellent" rating, and were in accord with the objectives of the program. Question 7 reflects a very positive atmosphere in the program.

The results of this questionnaire clearly indicate that the in-service program and the objectives were successfully met. It also clearly indicates that the strategies of the program were understood.

The third process objective called for each teacher in the program to have a clear understanding of the classroom demonstrations conducted by the practicum coordinator. In order to evaluate how effectively this was achieved, a questionnaire was issued to each teacher in the program, and the responses analyzed. Each question was to be rated on a scale of 1 (excellent) to 5 (poor). The results of the questionnaire are presented below. Each school's average score is indicated in the right hand column.

Table IX

CLASSROOM DEMONSTRATION QUESTIONNAIRE

The following questions pertain to the program for implementing the Metric System in grades K-6. Please indicate your response based on the scale below by placing the corresponding number in the right hand column.

1. Excellent
2. Very Good
3. Average
4. Below Average
5. Poor

	JACKSON MAIN	LUDLUM
1. Did you receive enough information from the coordinator regarding the classroom demonstration?	1	1
2. Did you find the classroom demonstration helpful?	1	2
3. Did the classroom demonstrations give you enough information on the techniques and use of Metric materials?	2	2
4. If you were having difficulties duplicating the lessons, did the coordinator assist you during the course of the In-Service Program?	1	1
5. Did you understand the objectives of the classroom demonstration?	1	1
6. Was there enough printed material on the lesson demonstrated?	2	3
7. Did you understand the demonstration well enough to duplicate it?	1	2

Please write below additional comments that you feel about the classroom demonstrations.

The two schools reacted favorably to Question 1. This is not unusual since the practicum coordinator formed the heart of the program and was the chief provider of information. The classroom demonstrations in Question 2 were helpful. Ludlum School scored a very good rating of a 2.

In Question 4, responses indicated the teachers felt they received valuable assistance. Teachers perceived the role of the practicum coordinator in classroom demonstrations as more important than that which he played in the in-service hour.

The response to Question 5 regarding the objectives of the program indicated a clear understanding of the said objectives by all. The concept of classroom demonstrations was central to the motivation of teachers in the program.

The area that received the poorest rating in both schools was that pertaining to written information. Although there was adequate information in the form of descriptions of materials and outlines, teachers generally responded better to oral communication than to printed materials.

Understanding the classroom demonstration and the ability to duplicate the same was evaluated in Question 7. This question received an"excellent"rating at Jackson Main and a"very good"rating at Ludlum.

The results of this questionnaire did indicate a very clear understanding of the objectives and procedures of the Metric In-Service Program on the part of the teachers. Part of the evaluation of this program dealt with the individual sessions which were held between teachers in the program and the practicum coordinator.

The practicum coordinator was to see each teacher at least once a week, and a seond time if that teacher was having difficulties.

The fourth process objective included the on-going exchange and evaluation of the program by the coordinator and the rest of the participants. To fulfill this objective, it was necessary for the coordinator to keep in frequent contact with the Assistant Superintendent, building principals, and teachers.

The desired outcome of the Nova Practicum has been achieved. A number of staff members have worked together and exchanged ideas.

The planning sessions have proven beneficial, and the school or sites have not only assisted in the implementation of the program; they have also helped to enlarge its scope.

CHAPTER VII

Institutionalization and Dissemination

At Jackson Main and Ludlum Elementary Schools, the implementation of the Metric System in grades K-6 completed a formative year. It has been well received by the students, parents, teachers, and administration. It is now on its way to becoming a permanent part of the district's curriculum. At the conclusion of this year's effort, the program was established on a solid foundation, and will be the springboard for implementing the Metric System in the remaining six elementary schools in the district.

Since Hempstead is one of the few school districts in Nassau County that has such a program, BOCES will use it as a model for other schools in the county for possible adoption.

The institutionalization of the Metric System is now a permanent part of Jackson Main and Ludlum Elementary Schools. It was under close scrutiny by administration, staff,and parents. In large measure its acceptance and dissemination in the schools is credited for the success of this year's effort. The eventual goal of the metric program will be for other elementary schools in the district to begin implementing the SI System in the 1979-80 school year. By its nature, the metric system offers a challenge to students, teachers and administrators. There were obstacles to the program's success, but a start has been made with the inception of the program. The results of this

practicum's effort will assure permanent institutionalization and expansion in the Hempstead Public Schools.

There is every assurance that in both schools, the metric program has had a significant impact, and will continue as an integral part of the mathematics curriculum in both schools.

CHAPTER VIII

Conclusion

The response to the Metric System Program has been extremely positive on the part of teachers and administration. Assurance has been given by the Assistant Superintendent for Curriculum and Instruction to the two cooperating schools, that the program will continue in September. One indication of the success of the program as verified in the evaluation portion of this report was teacher response. The following comments are typical of the information solicited in the teacher questionnaire.

"I think the in-service course offered was much more challenging than most others I have had."

"It helped me to understand the Metric System and how to teach it."

"It made my year an exciting experience."

"I appreciate the interest the coordinator took in helping me get through a meaningful experience."

Now that the International System of Units is becoming the primary system of measurement in New York State, it is essential that metric education become a part of the Hempstead Public Schools curriculum.

The Metric Program in Jackson Main and Ludlum Elementary Schools has revived teacher interest, while preparing students both intellectually and in their attitude to become effective citizens in a metric society. It responds to the necessity of making each year a viable challenging one and forms an effective link between the curricula of the Hempstead Public Schools and New York State.

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APPENDIXES

Appendix 1

THE UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT
OFFICE OF THE PRESIDENT OF THE UNIVERSITY
AND COMMISSIONER OF EDUCATION
ALBANY, NEW YORK 12224

Friday
January 17
19 75

TO: City, Village and District Superintendents; Supervising Principals; Diocesan Superintendents; Elementary and Secondary Public, Private and Parochial School Principals; Boards of Cooperative Education Services

FROM: Commissioner Ewald B. Nyquist

SUBJECT: Policy Statement on Metric Education

The International Metric System of Measurement is now used by over 90 percent of the world's population. An estimated 80 percent of all current world production and trade is measured in international metric units. Due to the recent decision of England, Australia, and Canada to change to the International Metric System of Measurement, the United States now remains the only large industrialized nation uncommitted to a program of implementation of metric measures.

We have been conscious of the efforts of business, industry and government to increase the use of metric measure. The scientific community and the pharmaceutical and photography industries are already using the metric system. A number of large manufacturing companies are designing products with metric dimensions. In 1971 a long-range Metric Study conducted by the United States Congress recommended that this country change to the metric system through a voluntary, coordinated national program.

It is inevitable that many students now in school, and those about to enter, will live in a metric world. The metric system is already an integral part of such curriculum areas as science, mathematics, industrial arts and occupational education. The Department has released to the elementary schools the publication entitled "Let's Use the Metric System." We now propose a carefully planned and coordinated changeover to metrics in the instructional program of the schools of the State.

The State Education Department is in the process of establishing a Metric Committee of educators to secure advice and assistance with the metric educational program being developed. As a follow-up to the planning of this committee, a group of experts from business, industry and governmental agencies will be invited to work with the Department to devise ways that these institutions and agencies can complement the metric education program in such concrete ways as preparing metric traffic signs, converting scales and measurements for commercial purposes, and providing educational materials for the consumer.

Meanwhile, it is important for each school to reassess its instructional program in the light of the increasing trend toward metrics. In the initial planning stage, the following steps are suggested:

- Formation of study committees to determine the appropriate subject areas and methods for introducing metric measurement into the curriculum
- Presentation of manipulative learning activities for students
- Initiation of experimental or pilot metric programs

The Department's Metric Committee, under the Office of Instructional Services, will identify several pilot school districts in the 1974-75 school year to develop a variety of metrication models. Successful programs and practices will be disseminated for statewide information and adaptation.

School districts which are already involved in metrication are invited to share information on their programs with the Department.

Everett Lyons

THE UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT
ALBANY, NEW YORK 12234

ASSISTANT COMMISSIONER FOR
GENERAL EDUCATION AND
CURRICULAR SERVICES

DIVISION OF GENERAL EDUCATION
BUREAU OF MATHEMATICS EDUCATION
518 474-3900
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518 474-5831

November 16, 1978

Mr. Joseph A. Wright
District Math Coordinator
Hempstead Public Schools
185 Peninsula Boulevard
Hempstead, NY 11550

Dear Mr. Wright:

In response to your letter of 11/8/78, we recommend that schools being teaching metric measure as soon as students learn a standard measurement system. This will be first grade (in some schools - kindergarten), and should not involve conversions but should involve measurement with metric measuring devices.

The K-6 mathematics syllabus is being revised and is planned for distribution in the fall of 1979. The measurement strand will be predominantly metric.

Enclosed are booklets on the metric system. Please let me know if I can be of further help.

Sincerely yours,

Lee Negus

LeRoy Negus

Enc.

Appendix 3

Table 1

ELEMENTARY TEACHERS SURVEY

College Major or Minor	Elem. Ed.	Mathematics	Science	Social Studies	English	Music	Art	Other	
Major	23	0	3	5	1	0	0	0	Total # in Survey
Minor	9	1	0	0	0	0	0	0	32

Major: Designating the principal field of academic specialization chosen by teachers in this survey.

Minor: Designating a field of academic specialization requiring fewer class hours or credits than a major field.

The figures in each box represent the number of teachers with a major, or minor under each field of academic specialization.

Table 2

ELEMENTARY TEACHERS SURVEY

Number of Mathematics Courses

Number of credits	0	3	6	9	12	15	18	More
Method Courses	0	27	5	0	0	0	0	0
Content Courses	0	29	0	0	0	0	3	0

Method Courses: The procedures and techniques related to teaching mathematics.

Content Courses: The systematic analysis of mathematics.

Total Number in survey 32.

The figure in each box represent the number of teachers having taken courses in either methods,or content or both.

Table 3

ELEMENTARY TEACHERS SURVEY

In-Service Workshops

Number of Workshops	0	1	2	3	4	5	More
General Mathematics	0	5	7	20	0	0	0
Metric Education	30	2	0	0	0	0	0

General Mathematics: Workshops designed to improve the mathematical background of teachers. These courses are not limited in scope, area, or application.

Metric Education: Workshops designed to improve classroom teachers' techniques and skills in the metric area.

Total Number in survey 32.
The Figure in each box represent the number of teachers who had workshops in general mathematics, or metric education or both.

Table 4

ELEMENTARY TEACHERS SURVEY

Teaching Experience in Years Number of Years	1	2	3	4	5	6	7	8	9	10	More
Total Teaching Experience	4	2	5	1	3	2	4	5	0	0	6
Total Teaching Experience in Hempstead	4	2	5	4	3	2	4	2	0	0	6

The figure in each box represent the number of teachers corrosponding to the total teaching experience within the Hempstead Public Schools, and the total teaching experience.

Appendix 3 (continued)

Table 5

ELEMENTARY TEACHERS SURVEY

Recency of
Metric Experience

Year of Experience	1978	1977	1976	1975	1974	Previous
Total Number in Survey 32	0	3	1	1	0	0

The figure in each box represent the number of teachers and the year the teacher had metric experience.

Appendix 3 (continued)

Table 6

ELEMENTARY TEACHERS SURVEY

Metric Experience

	Teaching	Lived in Metric Country	College	Other
Total Number In Survey 32	0	0	3	2

The figure in the box represent the number of teachers, and their metric experience.

Appendix 4

TABLE 7

Results of the pre-and post-test administered to all third graders in September 1978, and June 1979.

Hempstead Basic Test of Metrics

Student Code	Mastery Level 45 out of 50	Items Correct Pre-Test '78	Items Correct Post-Test '79
B,M.	"	8	40
D,D.	"	13	39
F,M.	"	12	48
H,L.	"	9	45
H,D.	"	8	40
L,D.	"	7	40
L,S.	"	11	44
M,R.	"	10	40
R.	"	15	45
M,B.	"	7	42
M,M.	"	5	45
M,D.	"	16	48
D.	"	20	40
N,N.	"	10	41
P,V.	"	11	36
R,M.	"	12	48
M	"	13	39
S,S.	"	14	42

Appendix 4 (continued)

TABLE 7 Continued

Student Code	Mastery Level 45 out of 50	Items Correct Pre-Test '78	Items Correct Post-Test '79
B,V.	"	7	42
G,C.	"	12	48
G,M.	"	13	46
G,M.	"	8	40
G.	"	9	45
J,A.	"	10	45
J,T.	"	10	41
W,C.	"	5	41
W,S.	"	16	48
Y,T.	"	12	48
D,L.	"	18	47
H,M.	"	13	43
H,F.	"	17	40
H,R.	"	19	46
H,S.	"	16	43
P,C.	"	21	48
S,A.	"	20	45
S,T.	"	18	45
T,E.	"	16	43
C,C.	"	17	42

Appendix 4 (continued)

TABLE 7 Continued

Student Code	Mastery Level 45 out of 50	Items Correct Pre-Test '78	Items Correct Post-Test '79
D,V.	"	20	40
L,S.	"	22	44
L,T.	"	19	45
N,T.	"	19	41
O,H.	"	13	39
P,D.	"	9	45
R,G.	"	6	42
R,I.	"	14	36
S,W.	"	16	40
W,L.	"	12	41
B,J.	"	17	43
C,C.	"	13	41
H,T.	"	9	38
J,H.	"	16	42
P,V.	"	21	40
M,M.	"	20	40
M,C.	"	19	40
T,P.	"	14	34
T,S.	"	15	45
R,N.	"	8	42

Appendix 4 (continued)

TABLE 7 Continued

Student Code	Mastery Level 45 out of 50	Items Correct Pre-Test '78	Items Correct Post-Test '79
D,T.	"	12	48
E,P.	"	12	47
H,E.	"	12	48
H,K.	"	14	36
M,G.	"	11	40
W,K.	"	10	40
Y,J.	"	13	41
R,M.	"	17	45
C,A.	"	21	48
C.	"	10	40
H,L.	"	16	42
H,A.	"	12	40
P,K.	"	11	38
P,N.	"	18	36
S,E.	"	20	40
A,I.	"	23	46
D,M.	"	13	39
E,A.	"	20	40
M,C.	"	24	48
R,A.	"	9	31
B,K.	"	12	39

Appendix 5

TABLE 8

Results of the pre-and post-test administered to all sixth graders in September 1978, and June 1979

Bitter Mastery Test

Student Code	Mastery Level 16 out of 18	Items Correct Pre-Test '78	Items Correct Post-Test '79
B,P.	"	5	15
C,S.	"	8	16
C,R.	"	1	12
C.	"	7	14
D,E.	"	8	14
G,K.	"	8	16
G,M.	"	5	15
G,C.	"	4	12
H,C.	"	5	14
H,A.	"	3	13
J,C.	"	8	15
J,K.	"	9	15
J,R.	"	2	11
L,F.	"	8	17
M,T.	"	2	12
M,B.	"	7	14
M,I.	"	7	14

TABLE 8 Continued

Student Code	Mastery Level 16 out of 18	Items Correct Pre-Test '78	Items Correct Post-Test '79
M,C.	"	4	11
N,T.	"	3	12
P,T.	"	2	10
S,F.	"	8	16
S,S.	"	2	14
S,A.	"	7	14
W,R.	"	8	15
W.J.	"	3	14
W.	"	2	12
B,A.	"	0	11
B,M.	"	8	16
B,V.	"	4	12
B,C.	"	7	14
B,S.	"	7	14
B,F.	"	8	16
C,N.	"	3	12
C,K.	"	2	11
C,M.	"	3	12

Appendix 5 (continued)

TABLE 8 Continued

Student Code	Mastery Level 16 out of 18	Items Correct Pre-Test '78	Items Correct Post-Test '79
C,S.	"	8	16
C,C.	"	8	15
D,K.	"	2	14
E,D.	"	4	12
F,S.	"	5	15
G,D.	"	3	14
G.	"	8	16
D.	"	1	12
H,A.	"	2	12
M,D.	"	7	13
R,D.	"	4	14
R,T.	"	3	14
R,S.	"	6	14
S,S.	"	2	11
S,T.	"	3	10
S,R.	"	4	12
T,D.	"	8	10

Appendix 5 (continued)

TABLE 8 Continued

Student Code	Mastery Level 16 out of 18	Items Correct Pre-Test '78	Items Correct Post-Test '79
B,S.	"	8	15
B,C.	"	3	14
B,L.	"	4	14
G,L	"	7	16
G,M.	"	7	15
G,W.	"	8	17
H,M.	"	3	15
J,J.	"	2	12
J,N.	"	8	16
J,D.	"	3	15
L,A.	"	5	16
M,O.	"	4	16
M,G.	"	2	14
M,K.	"	4	16
N,U.	"	5	15
N,G.	"	3	15
P,V.	"	8	16
R,S.	"	8	16

Appendix 5 (continued)

TABLE 8 Continued

Student Code	Mastery Level 16 out of 18	Items Correct Pre-Test '78	Items Correct Post-Test '79
R,D.	"	3	12
T,S.	"	8	16
W,R.	"	7	14
W,G	"	1	14
A,D.	"	8	16
S,T.	"	6	15
S,S.	"	6	15
C,R.	"	5	17
M,C.	"	3	14
R,L.	"	6	18
P,L.		2	12
S,M.	"	5	15
W,P.	"	8	16
S,T.	"	12	18
H,T.	"	7	14
M,S.	"	4	12

Appendix 6

PEARL RIVER SCHOOL DISTRICT

Project MEASURE
37 Franklin Avenue
Pearl River, New York 10965
Phone: 914 735-4091

David B. Howell
Director

PRESENTING...

PROJECT MEASURE

Project MEASURE

OBJECTIVES

A complete series of objectives, listed according to a measurement learning schema representing current research knowledge, and field-tested for several years, forms the basis of the program. For each new property (eg. length, area, volume, weight or mass, etc.), the same basic series of objectives is repeated. The series illustrated below covers weight (or mass) for Grades 1-4.

Code Number	Objective
Grades 1-2 (Primary):	
P-W-1	Compare the weights of two different objects.
P-W-2	Measure weight in kilograms. (AN ILLUSTRATION OF ACTIVITIES IS ON THE NEXT PAGE.)
Grade 3:	
3-W-1	Compare two or more objects and determine which has the most weight.
3-W-2	Order several objects from least to greatest weight.
3-W-3	Estimate and measure approximate weight (to nearest 10 grams) of a small object on a balance scale for objects of 100 grams or less.
3-W-4	Using kilogram "bathroom scale" students should weigh themselves and keep a monthly personal record.
Grade 4:	
4-W-1	Choose and use appropriate measuring device to measure the weight of familiar objects.
4-W-2	Make reasonable weight estimates of common objects in grams and verify by direct measurement.
4-W-3	Estimate and weigh in grams various small objects using a balance scale.
4-W-4	State that 2 pounds is approximately equivalent to 1 kilogram.*

In all, there are 59 separate objectives for Grades 1-4. These are supported by a total of over 200 activities. Your students may not need to do every activity to achieve each objective, but there should be plenty of activities--just in case!

We recommend that measurement instruction occur in conjunction with any application where the opportunity arises, and at least weekly, throughout the year.

*NO translation between customary and metric units are made in this program except for a few rough approximations discovered in activities.

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Rev. 10/79

Appendix 6 (continued)

Project MEASURE

ACTIVITIES

Each objective is supported by a set of Activity Cards. Some of the activities are sequential, but most are independent. Most students will need to accomplish only one or two of the activities to master the objective. On an average, there are four activities for each objective.

The Activity Cards to support one objective are listed below.

Objective:

Grades 1-2
(Primary)

P-W-2 Measure weight in kilograms.

Activities:

P-W-2-A1

WEIGH-IN

Weigh yourself in the morning.

Weigh yourself after lunch.

Compare!

© Project MEASURE

P-W-2-A2

TWO ON A SCALE

You and your friend get on a scale.

How much do the two of you weigh?

Find another pair of children who weigh the same.

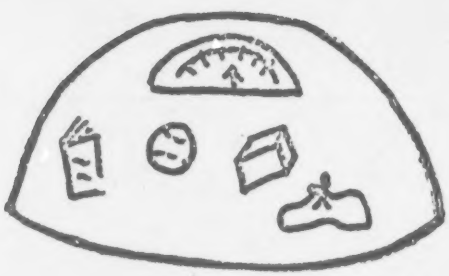
Find a pair who weigh less.

Find a pair who weigh more.

P-W-2-A3

SCALE PILE UP

Keep putting things on the scale until their weight equals yours.



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Project MEASURE

Appendix 6 (continued)

MATERIALS

Project MEASURE activities make heavy use of inexpensive materials students can bring to school and general classroom supplies. Students make many of the measuring implements they will use. A school staff, willing to share materials among classrooms, should be able to provide the minimum required implements for little more than $2.00 per pupil. Many schools already have much of the required material; their cost will obviously be even less.

A PARTIAL MATERIALS LIST REQUIRED BY THE PROJECT:

Some classroom supplies required-

- scissors
- string
- oaktag
- masking tape
- crayons
- rods (Cuisenaire or equivalent)

Some common objects students can bring from home-

- metal coat hangers
- coffee cans
- paper plates and cups
- food coloring

Some commercial measuring instruments-

- metric rulers and tape measures
- personal "bathroom" scale calibrated in kilogram
- balance
- graduated beakers
- Celsius thermometer
- set of standard metric weights

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Appendix 6 (continued)

Project MEASURE

WORKSHOPS

WORKSHOP I: AWARENESS

Objectives - Participants will be able to answer the following questions:

a. Why should the schools get into metric measurement instruction now?

b. How does Project MEASURE help?

c. What are some specific examples of how Project MEASURE works?

Time: 30-90 minutes

Audience: Teachers, Administrators, Curriculum Leaders--no limit on size of audience

Scheduling and Arrangements:

a. Large audience on regional basis, preferably coupled with Workshop II

b. Single district presentations in neighboring districts to allow scheduling 3 or 4 workshops per day

WORKSHOP II: ORIENTATION TO Project MEASURE

Objectives - Participants will be able to:

a. describe the components of the Project MEASURE curriculum.

b. describe the details of sample activities which will be done during the workshop.

c. describe administrative requirements for implementing/adapting Project MEASURE.

d. discuss cost factors involved in implementing/adapting Project MEASURE.

e. list decision-making steps to be taken locally toward possible further use of Project MEASURE.

Time: 2-3 hours

Audience: Teachers, Administrators, Curriculum Leaders--maximum number of participants without special advance arrangement: 35.

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WORKSHOP II: ORIENTATION TO Project MEASURE (continued)

Scheduling and Arrangements:

a. Regional or multi-district audience except for large district

b. Can be arranged for more than one workshop simultaneously to accommodate large audience

WORKSHOP III: Project MEASURE Curriculum Workshops for Metric Teachers

Objective - Participants will be able to implement Project MEASURE in their classrooms.

Time: 9-10 hours in not less than 2 separate sessions.

Audience: Teachers, and Administrators or Curriculum Leaders who want to learn the details of the measurement curriculum.

Scheduling and Arrangements:

a. Maximum of 35 participants

b. "Ideal" scheduling of six 1½-2 hour sessions. This can be modified for economic or local reasons to as few as two sessions of 4½-5 hours on separate days

c. Can be conducted as much as one year prior to implementation of Project or during the first few weeks of implementation

d. Designed for the teachers who will be implementing the program in their classrooms

WORKSHOP IV: Curriculum Workshops for Metric Leaders

Objective - Participants will be able to conduct Workshop III.

Time: 16-20 hours in not less than 4 sessions.

Audience: Teachers, Curriculum Leaders from a region or large district who will become metric leaders in the local area.

Scheduling and Arrangements:

a. Ideally scheduled as 8-10 two hour sessions, but may be modified to as few as four sessions on two separate days

b. Preferably, though not necessarily, participants will have some prior knowledge of metric measurement

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Appendix 7

Bismarck Public Schools

ELEMENTARY METRIC PROJECT
Roland B. Huber, Director

Think Metric

400 Avenue E East
Bismarck, N. Dak. 58501
Tele: 701-255-1987

March 28, 1978

Joseph A. Wright
Hempstead Public Schools
185 Pennisula Boulevard
Hempstead, NY 11550

Dear Mr. Wright:

Thank you for your interest in our Elementary Metric Project. I am enclosing a booklet which contains an overview of our project and a mini-sampler of the curriculum. After previewing these materials you may have questions about our project. Please feel free to call or contact me at my office.

Sincerely,

Roland B. Huber

Roland B. Huber
Project Director

RBH/tm
enclosure

Appendix 7 (continued)

OVERVIEW

This booklet contains an overview and samples of some of the materials contained in the Elementary Metric Project's curriculum for grades 1-6. This curriculum is now being made available to interested school districts at a nominal cost.

The project has been validated by the Joint Dissemination Review Panel and selected by the United States Office of Education for the National Diffusion Network. The network provides information and services to assist educators in making use of educational programs. Validation and approval was based on data collected for grades 4, 5 and 6. Supporting data is currently being collected for grades 1, 2 and 3 which will be used as evidence of effectiveness for additional program approval at this level.

This program was developed and implemented in the Bismarck School System, Bismarck, North Dakota, with Title III funds. It has since been implemented in the state of North Dakota by 80% of the school systems (public and non public). The project has been a member of the National Diffusion Network for one year and has obtained adoptions on a national level during this period.

The project has an outstanding record of helping teachers present metrics with confidence and of helping children achieve outstanding progress in metric education.

The purpose of the Elementary Metric Project is to disseminate the metric curriculum developed by the Bismarck metric project and to provide trainer and teacher inservice to selected potential adopters.

The metric trainer inservice includes twelve hours of intensive metric training for your school district representative(s). These trainers are to be inserviced and then return to their local school district to inservice the Local Education Agency classroom teachers. The component used for inservice consists of the following units: (1) Introduction to the Metric System; (2) Metre; (3) Litre; (4) Mass and (5) Temperature. A teacher inservice pre-post test has been developed and field tested to measure gains made in metric knowledge at the inservice workshop. Inservice workshops will be conducted at the project site or other arranged sites. Exemption to the inservice training will be granted to those agencies certifying that their teachers have had the equivalent of twelve hours of metric instruction and who complete the metric knowledge test. Should a district qualify for this exemption, key personel need to attend a four hour project implementation session in order to facilitate adoption installation.

The project's student curriculum includes coordinated-sequential objectives and curriculum, pre-post tests and answer keys and a teacher's manual containing suggested metric activities for each grade level (1-6). The curriculum consists of approximately fifty (50) activity lessons for each grade level. These activity sheets deal with linear measurement, mass (weight), volume (capacity) and temperature. The sequential arrangement of the curriculum allows for easy reproduction of activity sheets for classroom use.

Financial Requirement

Appendix 7 (continued)

Costs vary depending upon the number of students involved and present available metric equipment. The metric project provides a list of recommended metric hands-on materials to be coordinated with the teaching of the trainer inservice component and the student curriculum activities.

One copy of the curriculum need be purchased at $100 (our printing cost). This can be reproduced by the adopters in quantities sufficient to meet the needs of the school district. Necessary materials (this includes inservice packet for teachers, student curriculum and hands-on materials...costs of reproduction are not included) for an elementary school of approximately 350 students and 20 in-service staff members will cost about $500 provided there is no equipment on hand presently.

Adopting agency assumes the necessary costs of the teacher and trainer to participate in the inservice and implementation workshop.

Funding

Schools wishing to adopt the program may receive assistance from State Facilitator Projects or from their respective state department of education.

Services

Awareness materials are available at no charge. Visitors are welcome by appointment. Project staff are available to attend out-of-state awareness conferences (cost to be negotiated). Training and implementation services are provided at project or adopter site (cost to be negotiated).

The State Facilitator Project in your area may be able to provide additional information or assistance in pursuing an adoption. If you would like the address and phone number of the State Facilitator, or if you have any other questions, contact our office.

The Project Director will monitor the progress of the adoption installation and make on-site visits, as time and funds permit, to adopting districts in order to assess the degree of fidelity in the adoption and to render any appropriate technical assistance.

Adoption

The adopter school will need to complete a Metric Readiness Survey form provided by our office and, also, will need to be represented by a trainer for the inservice workshop. The adopter school trainer will conduct inservice training for teachers in his or her district and will be responsible for carrying out a management and evaluation plan designed by our office. The adopter school and Project Director will sign an agreement of committal to the project. Questions about adoption or requests for additional information about the project may be referred to our office. Interested potential adopters may contact:

ELEMENTARY METRIC PROJECT
A Member of the National Diffusion Network
Roland B. Huber, Director
400 Avenue E East
Bismarck, North Dakota 58501
Telephone (701) 255-1987

WAYNE-WESTLAND COMMUNITY SCHOOLS

project metric

450 SOUTH VENOY, WESTLAND, MICHIGAN (313) 326-6686

"THE SYMBOLIC NUMBER 10 SUGGESTS A COMPLETE CHANGE IN ALL DIRECTIONS OF LIFE TOWARD THE METRIC SYSTEM"

Thomas Yack, Director

Frank Higgins, Assistant Superintendent For Curriculum

December 14, 1978

Mr. Joseph Wright
District PSEN Coordinator
Hempstead Public Schools
185 Peninsula Boulevard
Hempstead, NY 11550

Dear Mr. Wright:

Thank you for your interest in Project Metric's instructional materials. Project Metric is the largest on-going metric program in the United States. The Project has numerous instructional materials appropriate for use at the elementary level.

A most comprehensive material is the *Elementary Metric Measurement Program;* it includes correlated instructional activities in linear, perimeter, area, volume, weight, and temperature. Also included are numerous games and suggested activities for integrating metric into social studies, art, and cooking. Also provided are bulletin board ideas, puppet patterns and parent take home lessons. Enclosed are some sample pages from that material.

I know you'll find the prices reasonable (cost recovery only) and materials carefully designed to produce a comprehensive metric measurement program.

Sincerely,

Thomas J. Yack, Director
Project Metric

TJY:jm

Enclosure

Appendix 9

WORKSHOP SCHEDULE DATES

Metric Education — Staff Development

Sept. 1978	5 (Ludlum)	12 (Jackson)	18 (Ludlum)	25 (Jackson)	
Oct. 1978	2 (Ludlum)	9 (Jackson)	16 (Ludlum)	23 (Jackson)	30 (Ludlum)
Nov. 1978	7 (Jackson)	14 (Ludlum)	21 (Jackson)	28 (Ludlum)	
Dec. 1978	5 (Jackson)	12 (Ludlum)	19 (Jackson)		
Jan. 1979	2 (Jackson)	9 (Ludlum)	16 (Jackson)	23 (Ludlum)	30 (Jackson)
Feb. 1979	6 (Ludlum)	13 (Jackson)	20 (Ludlum)	27 (Jackson)	
Mar. 1979	6 (Ludlum)	13 (Jackson)	20 (Ludlum)	27 (Jackson)	
April 1979	3 (Ludlum)	10 (Jackson)	17 (Ludlum)	24 (Jackson)	
May 1979	1 (Ludlum)	8 (Jackson)	15 (Ludlum)	22 (Jackson)	29 (Ludlum)
June 1979	4 (Jackson)	11 (Ludlum)			

Appendix 10

(516) 292-7009
292-7006

HEMPSTEAD PUBLIC SCHOOLS
BOARD OF EDUCATION OFFICE
185 PENINSULA BOULEVARD
HEMPSTEAD, NEW YORK 11550

ROBERT B. MORGAN, Ed.D.
Director
Personnel & Special Programs

MEMO TO: Joseph A. Wright

FROM: Robert B. Morgan

DATE: September 7, 1977

SUBJECT: In-Service Credits

In-Service credit will be granted to any teacher in the district based on the guidelines of the HCTA Contract:

A. Teachers may be placed at the highest pay scale class consistent with the total of graduate points and Hempstead system in-service points credited, provided, however, that not more than one-third of the total points so offered may be earned through in-service study.

B. The in-service credits recognized for the purpose of this section are Hempstead, State and BOCES in-service credits.

Teachers participating in the math in-service program will receive one in-service credit to be used upon completion of the course for salary increment.

Appendix 11

STAFF DEVELOPMENT PROPOSAL

1. Metric Workshops (15-20 participants in each group). Twenty hours of metric education for teachers and administrators.

   a. Hands-on metric measurement activities that can be used with children.

   b. The study of concepts of length, area, volume, mass(weight), and temperature.

   c. The use of models(body references, familiar objects) for key units of measure.

   d. An examination of the relationships among the numeration, monetary, and measurement (metric) systems.

   e. Conversion within the metric system.

   f. Distribution of reproducible activity and apparatus sheets.

2. Follow-up Activities

   a. Grade-level curriculum and problem-solving sessions.

   b. Classroom visitations, cooperative teaching, individual teacher conferences.

   c. Supervision conferences with administrator(s).

   d. Assistance with the selection of instructional materials.

Appendix 11 (continued)

OBJECTIVES

Kindergarten

The student will pronounce the words: metre, centimetre, litre, gram and kilogram.

The student will select metre and centimetre as units for length.

The student will choose the longer (shorter) of two given objects relatively linear in nature. (Pencils, chalk, rods)

The student will select an appropriate object from a group of familiar objects when asked to choose one "about as long as a metre stick."

Grade 1

The student will identify a metre stick that is labeled but not necessarily scaled.

The student will identify a centimetre division on a metric ruler.

The student will select both "metre" and "centimetre" as words related to a scaled metre stick.

The student will associate "metre" and "centimetre" to length terms such as long, short, tall, high, wide, etc.

The student will associate "litre" to the measurement of liquids such as milk and water.

The student will associate "kilogram" to the measurement of mass (or weight!) on a beam or balance scale (or personal scale).

The student will directly compare two objects and classify one as longer than, shorter than, or equal to the other.

The student will compare and order on length two pictorial representations of objects.

The student will compare and order areas directly by covering.

The student will compare and order mass directly using a simple scale.

The student will compare and order capacity directly by pouring.

The student will recognize a body referrent for the metre and for the centimetre.

The student will describe the metric system as something "new" for everyone to learn.

OBJECTIVES

Grade 2

The student will read the words metre, centimetre, litre, gram and kilogram.
The student will select the symbol for the words metre and centimetre.

The student will read a Celsius thermometer in whole degrees.

The student will state the relationship between m and cm.

The student will identify metre, centimetre, gram, kilogram, litre and Celsius as metric words.

The student will identify at least 5 situations in his environment that will involve (metric) measurement.

The student will compare and order 2 line segments using a cm ruler and whole standard units.

The student will compare and order 2 closed regions of similar shape by visual comparison.

The student will measure the length of a pictorial representation in whole cm.

The student will determine the capacity in whole litres of a given container by pouring with a litre cup.

The student will fill a graduated beaker to the 1-litre mark.

The student will determine whether a small object has mass greater than, less than or equal to a 1-kg weight using a simple scale.

The student will identify the metric system as the measuring system he will use most in the future.

Appendix 11 (continued)

OBJECTIVES

Grade 3

The student will select the word form of m, l, g, and kg.

The student will place the common metric prefixes in order on a place value chart.

The student will identify freezing point, boiling point, body and room temperatures on the Celsius scale.

The student will differentiate between km, m, dm, cm.

The student will compare and order measurements in cm^2.

The student will compare and order on area two rectangular regions with sides in whole cm using a transparent cm grid.

The student will estimate lengths in cm.

The student will measure classroom distances to the nearest whole metre.

The student will measure distances less than one metre to the nearest decimetre.

The student will determine the area in cm^2 of a rectangle with sides in whole cm using a transparent cm grid.

The student will measure a liquid correctly to the nearest 100 ml using a calibrated beaker.

The student will determine the volume in cm^3 of a rectangular solid by counting cm cubes or by constructing a similar object with cm cubes.

The student will determine the perimeter of a rectangle or a parallelogram by measuring in whole cm.

The student will determine the approximate mass in grams of a small object using a balance scale to within 10 grams for objects of 100 g or less.

The student will read height in cm and his own weight in kg.

The student will determine the sum and difference of two like measures.

The student will construct a line segment of arbitrary length in whole cm.

The student will recognize the metric system as a measuring system comparable to the English system.

OBJECTIVES

Grade 4

The student will state the six common metric prefixes and their meaning.

The student will select the symbol that matches each common metric term.

The student will identify a negative temperature as "very cold."

The student will use the relationships $l \rightarrow ml$, $g \rightarrow kg$, $m^2 \rightarrow cm^2$, $1\ l = 1\ 000\ ml$, $1\ kg = 1\ 000\ g$.

Given an arbitrary temperature in whole degrees Celsius, the student will record it on a C scale.

The student will compare and order measurements in whole m^2, dm^2, and cm^2.

The student will compare and order measurement in dm^3 and in l.

The student will estimate lengths in m and mm.

The student will measure length to the nearest mm.

The student will estimate areas of triangular regions by counting units and half-units using a transparent grid.

The student will calculate the perimeter in cm of irregular polygons.

The student will measure temperatures to the nearest whole degree.

The student will calculate multiples and even divisions of metric measurements expressed in whole units.

The student will change from $km \rightarrow m \rightarrow dm \rightarrow cm \rightarrow mm$ by multiplication.

The student will change from $cm \rightarrow dm$, $dm \rightarrow m$, $mm \rightarrow cm$ by dividing by 10 when no decimal results.

The student will solve simple word problems that involve addition and subtraction of metric measurements.

The student will state the approximate age and national orgin of the metric system.

The student will identify the general correspondences: $m \rightarrow yd$, $cm \rightarrow in$, $kg \rightarrow lb$, $l \rightarrow qt$, $^{\circ}C \rightarrow {}^{\circ}F$.

Appendix 11 (continued)

OBJECTIVES

Grade 5

The student will write the metric word to match each common symbol.

The student will recognize local seasonal temperature variations in °C.

The student will use the relationships:
km ↔ hm ↔ dam ↔ m ↔ dm ↔ cm ↔ mm, kg ↔ g ↔ mg, kl ↔ l ↔ ml.

The student will use the relationship $dm^3 \leftrightarrow l$ in volume and $l \leftrightarrow kg$ in mass of cold water.

The student will compare and order measures in m^3, dm^3, cm^3, kl, l, ml.

The student will make reasonable estimates of the length, mass, and capacity of common classroom items.

The student should read and record in °C the temperature of liquid as it is heated or cooled.

The student will fill a calibrated beaker to an arbitrary measure.

The student will find the sum and difference of two measurements expressed in decimal notation.

The student will calculate the area of a rectangle using the base x height = area formula and measurements in whole units.

The student will express linear measurements correct to the nearest 0.1 m and 0.1 cm.

The student will change mm → cm → dm → m → dam → hm → km, mg → g → kg, ml → l → kl by dividing by 10, 100, or 1000.

The student will solve word problems that involve multiplication of integers times metric measurements (or division of metric measurements by integers). (Whole units only).

The student will explain <u>how</u> the metric system originated.

The student will identify the advantages of using a common set of prefixes with all root words.

The student will make the gross comparisons:
a <u>m</u> is a little <u>more</u> than a <u>yd.</u>, a <u>l</u> is a little <u>more</u> than a <u>qt.</u>,
a <u>kg</u> is a little <u>more</u> than <u>2 lbs.</u>. a <u>cm</u> is a little <u>less</u> than <u>half</u> <u>an</u> <u>inch</u>.

OBJECTIVES

Grade 6

The student will recognize these symbols as words: km/h, m/s, km/s.

The student will read metric road signs such as Speed Limit 80 km/h, Raleigh 170 km.

The student will state the linear dimensions of the measurements: m^2, dm^2, cm^2, m^3, dm^3, cm^3.

The student will read a line graph showing variations in outdoor temperature over a period of a week in °C.

The student will use the relationships ha $\longleftrightarrow$ a $\longleftrightarrow$ m^2, t $\longleftrightarrow$ kg.

The student will rename all common metric linear measurements in equivalent values including square and cubic units.

The student will compare and order measurements in the same base unit.

The student will select an appropriate unit of measurement for common objects in his environment from the set: km, m, cm, mm, kg, g, l, ml.

The student will heat a liquid to an arbitrary °C temperature.

The student will calculate the volume of a rectangular solid using metric measurements in decimal notation.

The student will perform multiplication and division operations on metric measurements expressed in decimal notation.

The student will change $cm^2 \longrightarrow dm^2 \longrightarrow m^2 \longrightarrow$ a $\longrightarrow$ ha, kg $\longrightarrow$ t.

The student will express linear measurements correct to 0.001 m and 0.001 km; capacity measurements to 0.001 l; and mass to 0.001 kg.

The student will calculate the area of a rectangle with sides expressed in decimal notation.

The student will calculate tha area of triangles, parallelograms and trapezoids using base-height formulas and whole metric units.

The student will make a graph to show comparisons of metric units.

The student will relate some of the historical development of the metric system.

The student will explain the concept and value of a decimalized system.

The student will recognize the advantages of a world-wide measurement system in world communications.

The student will be able to compare English to metric measures given an appropriate printed conversion chart.

METRIC IN-SERVICE WORKSHOP: I

ORIENTATION SESSION

Purpose : Participants will become aware of the following:

a. The nature of the program.

b. Objectives of the program.

c. Role definitions

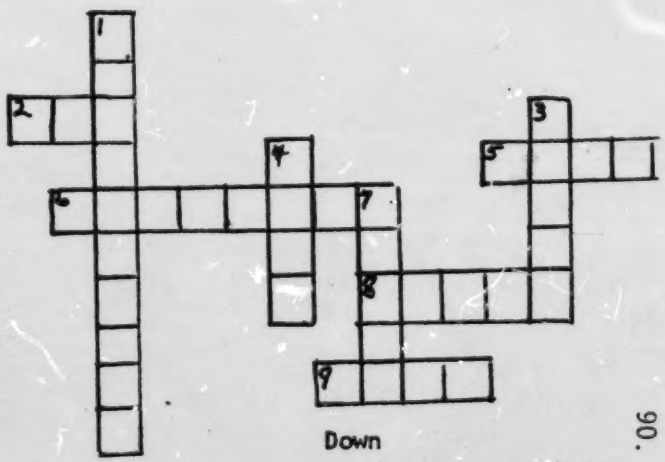
Time: 90 minutes.

Audience: Teachers, Administrators, Curriculum Coordinators--
number of participants: 35.

METRIC IN-SERVICE WORKSHOP:

MEASURES OF MASS (WEIGHT)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To demonstrate the use of place value in reading metric measurements that are recorded in decimal form. To demonstrate the use of a place value chart as an aid in renaming metric units; To demonstrate that the Metric System is a decimal-based system and somewhat parrallels the Decimal Numeration System as shown in this chart. **Decimal** — **Metric** hundreds thousands · tens · ones · tenths · hundredths · thousandths Kilo · Hecto · Deca · Base Unit · Deci · Centi · Milli **Time:** 1 hour. **Audience:** Classroom teachers **Materials:** place value chart	**Purpose:** To demonstrate the relation of the place value system used with U.S. money to the place value system used with the metric system. To compare the recording of U.S. money with the recording of metric measurements. To identify and name metric prefixes. **Vocabulary:** place value, prefix, multiple, kilo, deci, centi, milli. **Time:** 45 minutes **Grade:** Four, Five and Six **Materials:** place value charts	To demonstrate knowledge of the metric system by solving crossword puzzle. Have pupils create puzzles to reinforce and review metric terms. Have pupils prepare scrambled metric terms for their classmates to unscramble. Have pupils prepare incomplete sentences which can be made true by supplying a metric term.



Across

2. millimeters in 1 centimeter
5. prefix that means $\frac{1}{100}$
6. 1000 g = 1
8. base unit for measuring capacity.
9. prefix that means 1000

Down

1. one hundreth of a meter
3. base unit for measuring length
4. base unit for measuring mass
5. prefix that means $\frac{1}{1000}$

Sample Wroksheet

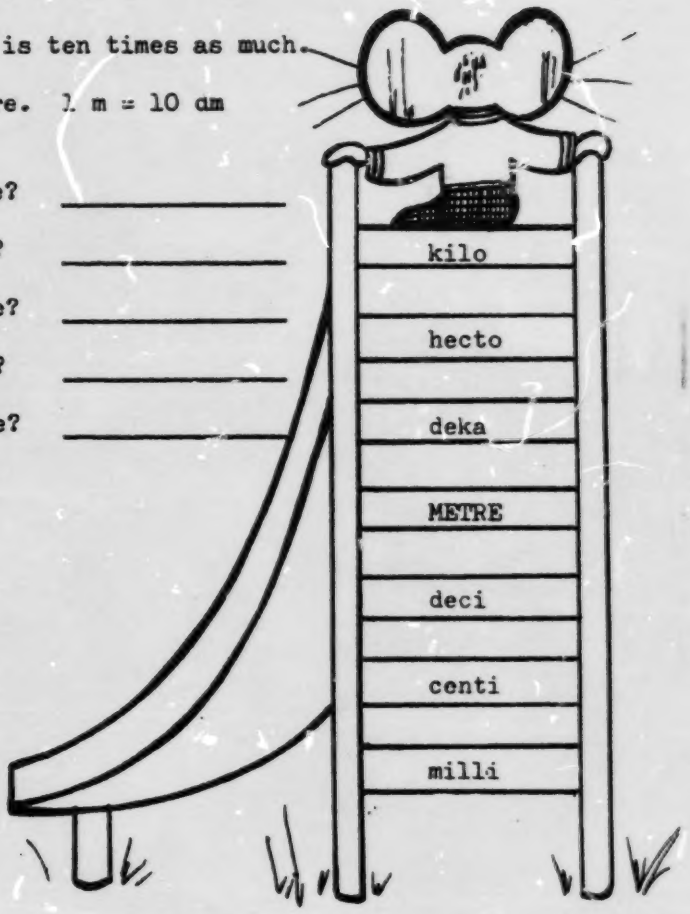
PLACE VALUE

One step up from any given place is ten times as much.

A metre is 10 times a decimetre. 1 m = 10 dm

1. What is 10 times a millimetre? _____
2. What is 10 times a decimetre? _____
3. What is 10 times a centimetre? _____
4. What is 10 times a dekametre? _____
5. What is 10 times a hectometre? _____

We use units of 10 for changing from one metric unit to another.



Two steps up from any given place is 100 times as much.

A metre is 100 times a centimetre. 1 m = 100 cm

6. What is 100 times a metre? _____
7. What is 100 times a centimetre? _____
8. What is 100 times a millimetre? _____
9. What is 100 times a dekametre? _____

Three steps up from any given place is 100 times as much.

A kilometre is 1000 times a metre. 1 km = 1000 m

10. What is 1000 times a metre? _____
11. What is 1000 times a millimetre? 100 _____

The student will be able to write out the six common prefixes and describe what each means.

METRIC IN-SERVICE WORKSHOP:

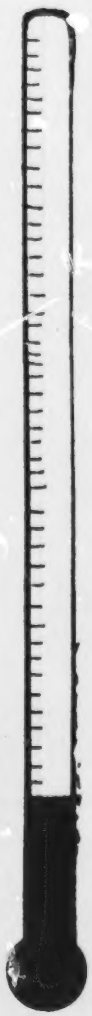
THE CELSIUS THERMOMETER
(Temperature)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify ^{0}C as the symbol for degrees Celsius To select Celsius temperature reading for a specified condition using $0^{\circ}C$, $22^{\circ}C$, $37^{\circ}C$, and $100^{\circ}C$ as points of reference To mark the degrees on a model of a Celsius thermometer, using the scale 1 cm= 10° To find the temperature of water under different conditions Time: 1 hour Audience: Teachers, Administrators.--number of participants 15-20 Materials:celsius thermometers	Purpose: To identify a Celsius thermometer. To read a Celsius thermometer marked in 2° intervals To find the temperature of water under different conditions. Vocabulary: Fahrenheit, Celsius, Thermometer, degrees, interval Time: 45 minutes. Grades: Four, Five and Six. Materials: Celsius thermometers, water under varied conditions.	Provide pupils with many opportunities to read a Celsius Thermometer. Have pupils research the history of Celsius and make oral and written reports. Provide varied situations in which pupils can extimate and then read Celsius temperatures. Have pupils associate approximate Celsius temperature readings with their everyday experiences.

Sample Worksheet

TEMPERATURE ACTIVITIES

Find the temperature of the things listed on this graph in degrees Celsius (C). Color each column to the correct temperature.



100°C	
95°C	
90°C	
85°C	
80°C	
75°C	
70°C	
65°C	
60°C	
55°C	
50°C	
45°C	
40°C	
35°C	
30°C	
25°C	
20°C	
15°C	
10°C	
5°C	
0°C	
-5°C	

ROOM TEMPERATURE	TEMPERATURE IN THE HALLWAY	HOT TAP WATER	DRINKING WATER	ICE WATER	HOLD THE THERMOMETER BETWEEN YOUR HANDS	SNOW BANK	A PILE OF LEAVES	YOUR CHOICE

The student will be able to measure temperature in Celsius degrees to the nearest whole degree.

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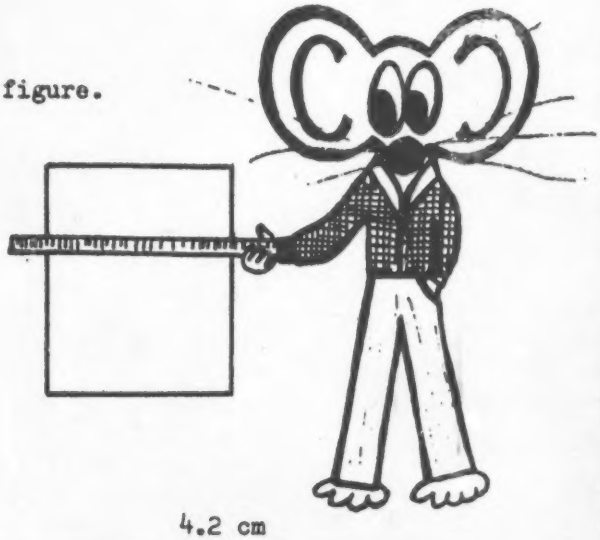
METRIC IN-SERVICE WORKSHOP:
LINEAR MEASURE

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To find the area of a plane figure by counting the number of centimeter squares (cm^2) its surface covers. To demonstrate a personal use for finding area To compute the area of rectangles Time: 1 hour Audience: Teachers, Administrators--number of participants 15-20 Materials; transparent centimeter grid, centimeter grid paper	Purpose: To find the area of a plane figure by counting the number of centimeter squares (cm^2) its surface covers To demonstrate estimation of area measurement by computing the portion of each cm^2 covered by curved sections To demonstrate a formula for finding the area of a rectangle. Vocabulary: surface, area, square, formula, congruent, equal, equivalent. Time: 45 minutes Grades: Four, Five and Six. Materials: Centimeter geoboards	Ask pupils to draw four different plane figures, each having an area of 12 cm^2, Have them find the perimeter of each shape and compare the results. Direct pupils to compute the number of mm^2 in 1 square centimeter, in 1 square decimeter, and 1 square meter

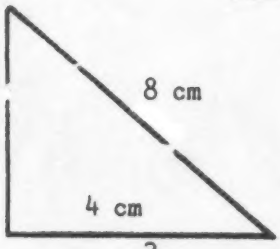
Sample Worksheet

AREA



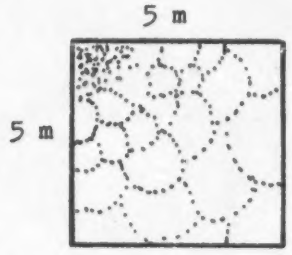
Find the area of each figure.

1.



Area: _____ cm^2
(area of a triangle = ½ base x height.)

2.

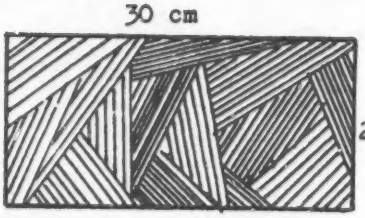


Area: _____ m^2

3.

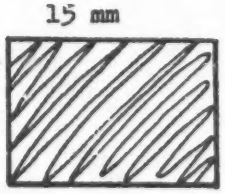
Area: _____ cm^2

4.



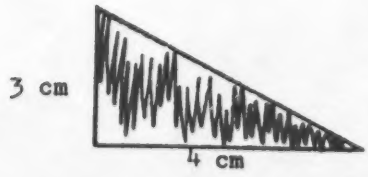
Area: _____ cm^2

5.



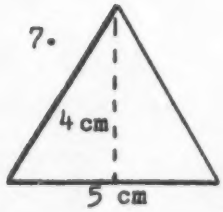
Area: _____ mm^2

6.



Area: _____ m^2

7.



Area: _____ cm^2

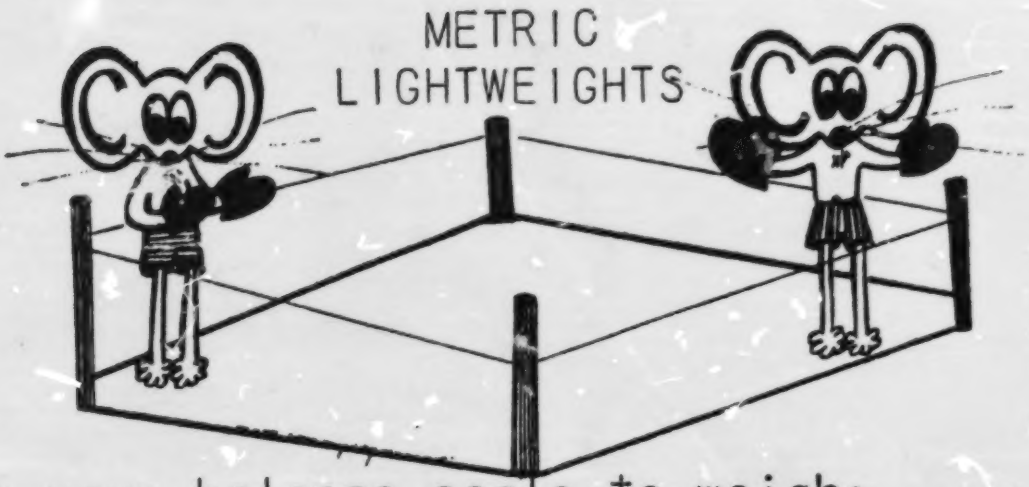
The student will be able to find the area of a given geometric figure.

METRIC IN-SERVICE WORKSHOP:

MEASURES OF MASS (WEIGHT)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To express equivalent masses using milligrams, grams, kilograms, and tons. To identify objects which can be measured by t, kg, g, and mg mass units. To compare measurements in grams with measurements in kilograms. To assign approximate weights to specific objects To select probable statements, given a number of statements that involve milligrams, grams, kilograms, and tons. Time: 1 hour. Audience: Teachers, Administrators--number os participants: 15-20.	Purpose: To identify objects which can most efficiently be measured by t, kg, g, and mg mass units. To compare measurements in grams with measurements in kilograms Vocabulary: milligram, metric ton, kilogram Materials: milligram, kilogram, and gram masses, scale Time: 45 minutes Grades: Four, Five and Six.	Have pupils bring in advertisements from magazines. Then ask them to label each advertised item with the appropriate metric unit of mass. Prepare a set of pictures and a set of acrds. Each card is to indicate the approximate mass of one pictured object. Have pupils match card and object.

Sample Worksheet



Use your balance scale to weigh:

1. How many raisins make 10 grams? _____
2. How many small paper clips make 10 grams? _____
3. How many of each do you think would make 50 grams? _____
   _____
4. How many raisins would make 1 kilogram? _____
5. Find other objects less than 200 grams. Record the results below.

_____

_____

_____

_____

_____

The student will be able to measure mass (weight) of objects in grams or kilograms on a balance scale or similar metric scale.

METRIC IN-SERVICE WORKSHOP:

LINEAR MEASURE

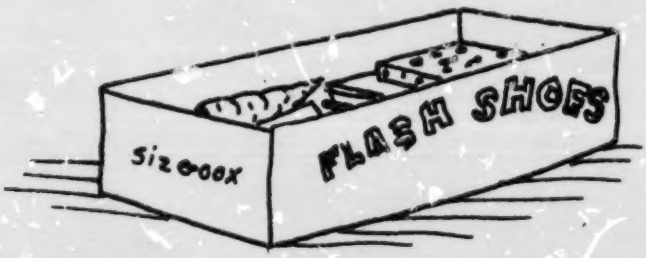
Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify and name a centimeter unit. To count centimeters on a ruler. To identify the relationship between centimeters, decimeters, and meters. To write a measurement three ways: as centimeters, as centimeters and meters, and as meters, decimeters, and centimeters. Time: 1 hour. Audience: Teachers, Administrators, Curriculum Coordinators--number of participants: 15-20. Materials: tape measure or centimeter rulers and meter sticks, height chart two meters long, marked in centimeters.	Purpose: To identify and name a centimeter unit. To count centimeters on a ruler To identify cm as the symbol for centimeters. To demonstrate that the greater unit, the smaller the number of units needed; and the smaller the unit, the greater the number of units needed to measure an object or distance. To write a measurement three ways: as centimeters, as centimeters and meters, and as meters, decimeters, and centimeters. Vocabulary: centimeter, relate, equivalent, accurate, distance farther, height, tall Time: 45 minutes Grade: Four, Five and Six Materials: height chart two meters long marked in centimeters, meter sticks, centimeter rulers.	Write centimeter measurements such as 5cm, 8cm, or 25cm, on cards. Then have pupils explore the classroom to find objects having those measurements. Have several pupils estimate the measurement of a given object in centimeters. Then have them measure the object to find who made the best estimate. Have pupils make bar graphs showing the heights of the boys and of the girls. Then have the graphs used to find the average height of the boys and of the girls. Have pupils measure distances in centimeters and use a place value chart to rename centimeters as meters. Have pupils measure each other in meters and centimeters. Then have change the measurements to cemtimeters in order to compare.

Appendix 11 (continued)

Sample Wroksheet

Call It

Play "call it" with a friend. You will need a shoe box of small objects, a rule, and a game sheet.



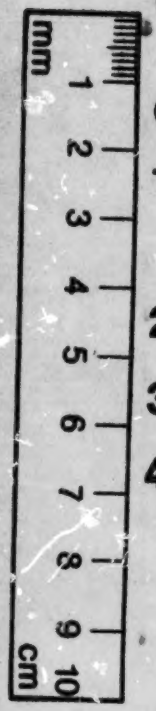
1. Take turns by reaching into the shoe box and taking out an object.
2. Estimate out loud the length of the object in centimeters. Record on the game sheet.
3. Now measure the object with a centimeter rule. Record on the game sheet.
4. For each pair of objects, the player whose estimate is closest to the actual length is awarded a check (✓) in the point column.
5. First player to ten checks wins.

	Estimate	Actual	Point		Estimate	Actual	Point
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

METRIC IN-SERVICE WORKSHOP:
LINEAR MEASURE

Teacher Training Session	Classroom Demonstration	Activities
Purpose:To identify the relationship between millimeters, decimeters,and meters. To demonstrate that the greater the unit, the smaller the number of units needed; and the smaller the unit, the greater the number of units needed to measure an object or distance. To compute with millimeters To estimate line segments in centimeters and millimeters by drawing lines to specified lengths. To draw shapes to specifications given in centimeters and millimeters. Time: 1 hour Audience: Teachers,Administrators.Number of participants:15-20. Materials: Compass, ruler marked in centimeters and millimeters.	Purpose: To name and identify the millimeter. To measure in millimeters and centimeters To demonstrate that the smaller the unit of measure, the more accurate the measurement. Vocabulary: denominator, segment, millimeter, tenth, thousandth. Time: 45 minutes. Grades: Four, Five and Six. Materials: rulers marked in centimeters and in millimeters	Have pupils make a collection of objects that should be measured in millimeters. Have students determine the speed limit in their communities in kilometers.

Sample Worksheet



explore

1 Write the units shown on this ruler.

A. millimeter B. centimeter C. decimeter

2 Which unit is needed to measure the thickness of a dime? millimeter

3 We write mm for millimeter.

4 Which one number makes these true sentences?

A. 10 mm = 1 cm

B. 10 cm = 1 dm

C. 10 dm = 1 m

D. 1 mm = $\frac{1}{10}$ cm

E. 1 cm = $\frac{1}{10}$ dm

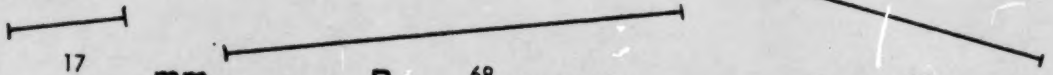
F. 1 dm = $\frac{1}{10}$ m

try

1 Measure widths of film.

A. 8 mm B. 16 mm C. 35 mm

2 Measure each line segment in two ways.



A. 17 mm = 2 cm

B. 68 mm = 7 cm

C. 73 mm = 7 cm

D. Which is the more accurate measurement, mm or cm? mm

Why? *The smallest unit provides for the least amount of error.

*Accept any reasonable answer.

METRIC IN-SERVICE WORKSHOP:

MEASURES OF MASS (WEIGHT)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To demonstrate that objects having the same volume may have different masses. To demonstrate that objects having the same mass may have different volumes. To name and identify the gram as a unit of mass. To identify g as the symbol for gram. To name and identify the Kilogram as a unit of mass. To identify kg as the symbol for kilogram. Time: 1 hour. Audience: Teachers, Administrators, Curriculum Coordinators--number of participants: 15-20 Materials: balance scale, assorted materials to be weighed, Kilogram and gram masses.	Purpose: To identify the metric ton as the appropriate unit of measure for very heavy things. To identify t as the symbol for metric ton. To express equivalent masses using milligrams, grams, kilograms, and tons. To compute with units of mass. To compare measurements in grams with measurements in kilograms. Vocabulary: mass, weight, density gram, kilogram, weigh. Time: 45 minutes. Grades: Four, Five and Six Materials: balance scale, gram and kilogram masses, assorted materials to be weighted	After lifting and handling objects around the room, have participants describe the mass of each object. Ask them to compare the objects by designating the heavier, the lighter, and those equal in mass. Have participants determine the mass of as many objects as possible in grams and kilograms. Prepare a set of picutres and a set of cards. Each card is to indicate the approximate mass of one pictured object. Have pupils match card and object.

[redacted]

explore

1 We write *t* for metric ton.

2 Which one number makes this table true?

1000 mg = 1 g 1000 g = 1 kg 1000 kg = 1 t

3 How many grams in one metric ton? 1 000 000 g

try

List objects measured by each unit.

Metric Ton	Kilogram	Gram	Milligram
* elephant airplane car	* girl horse cheese sugar	* ring glove glasses screw	* candy pill

*Answers will vary. These are some possible answers.

METRIC IN-SERVICE WORKSHOP:

LINEAR MEASURE

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify various measuring tools. To identify a meter as a unit of length or distance. To explain the need for congruent units of measure To identify and name a meter To measure in meters To identify m as the symbol for meter. Time: 1 hour Audience: Teachers, Administrators, Curriculum Coordinators--number of participants: 15-20.	Purpose: To identify various measuring tools. To use devices for measuring. To count the number of steps from one point to another To compare pupil answer after using non-standard units to measure. To identify a meter as a unit of length or distance and name a meter Vocabulary: measurement, tool scale, odometer, tape measure, high, wide, deep, heavy, unit. Grade: Four, Five and Six Materials: Tape measure, balance scale, measuring cup, odometer, thermometer, meter stick, string, scissors. Time: 45 minutes	Provide the opportunities for the class to measure lengths of different objects. Permit pupils to estimate and measure distances in meters. Have pupils to measure objects in meters and in decimeters. Then have them compare the number of unit of measurement needed to measure the given object.

Count meters.

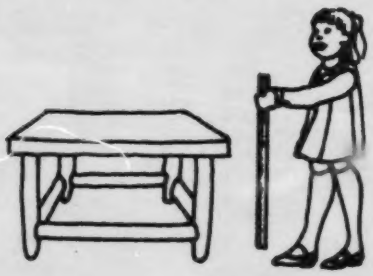
explore

Use your meter length or a meter stick. Measure a table.
How many meters:

A. long? _____* m

B. wide? _____* m

C. high? _____* m



try

1 Estimate (guess). Then measure.

A. About how many meters high can you reach?

Estimate _____* m Measurement _____* m

B. About how many meters can you jump?

Estimate _____* m Measurement _____* m

C. About how many meters can you throw a ball?

Estimate _____* m Measurement _____* m

2 Are you a good judge of distance? _____*

Why? (Accept any reasonable answer.)

*Answers will vary.

METRIC IN-SERVICE WORKSHOP:
LINEAR MEASURE

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify and name decimeter unit. To name a decimeter as on tenth of a meter and 10 decimeters as a meter. To measure a given distance in meters and in decimeters. To compare a given number of decimeters and a given number meters Time: 1 hour. Audience: Teachers Administrators , Curriculum Coordinators-number of participants: 15-20 Materials: manila tag, scissors meter stick (or tape measure or metric ruler) maked in decimeters.	Purpose:To identify and name a decimeter unit. To measure a given distance in meters and in decimeters. To name a decimeter as one tenth of a meter and 10 decimeters as a meter. To compare a given number of decimeters and a given number of meters Vocabulary: estimate, measurement, distance, compare, decimeter, depth, width, height. Time: 45 minutes Grade: Four, Five and Six Materials: meter stick or string one meter long, metric ruler.	have pupils to measure objects in the classroom in meters and in decimeters. Then have them compare the number of each unit of measurement needed to measure the given object.

Sample Worksheet

1 dm = 10 cm

Work with centimeters and decimeters.

explore

Measure. Write each measurement two ways.

A.

dm and 1 cm — 11 cm

B.

1 dm and 2 cm — 12 cm

C.

1 dm and 3 cm — 13 cm

D.

1 dm and 4 cm — 14 cm

try

Make true sentences.

A. 1 dm = 10 cm

2 dm = 20 cm

6 dm = 60 cm

B. 1 dm and 6 cm = 16. cm

1 dm and 7 cm = 17 cm

1 dm and 9 cm = 19 cm

C. 15 cm = 1 dm and 5 cm

23 cm = 2 dm and 3 cm

D. 15 cm (>) 1 dm

42 cm (<) 5 dm

METRIC IN-SERVICE WORKSHOP :
LINEAR MEASURE

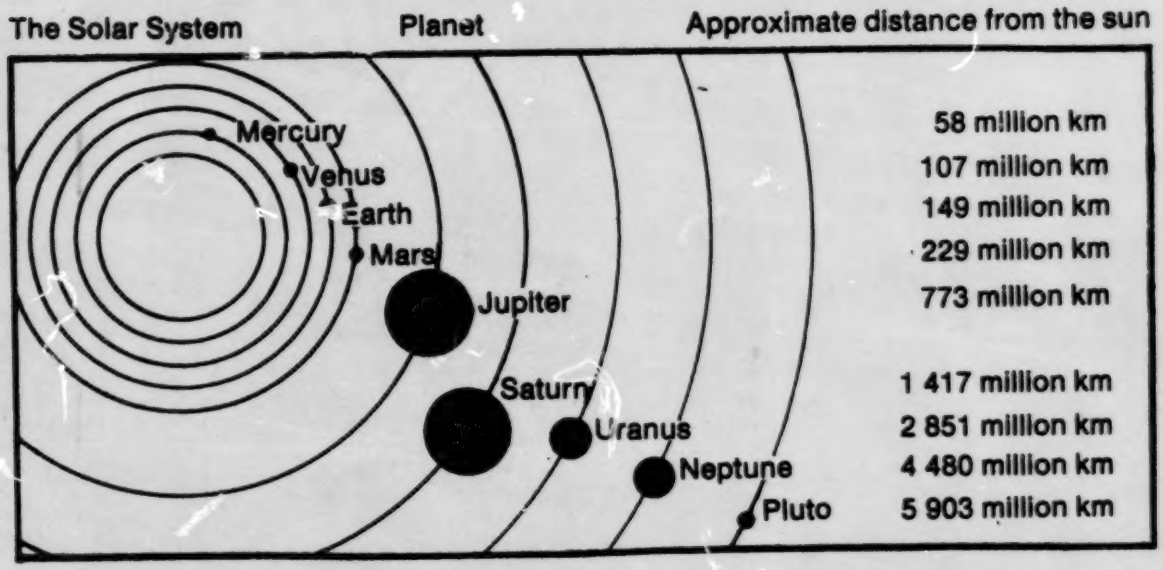
Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify and name the kilometer as a measure of distance. To demonstrate the relationship of meters to kilometers To rename meters as kilometers and kilometers as meters Time: 1 hour Materials: rulers marked in centimeters and millimeters Audience: Teachers, Administrators--number of participants 15-20.	Purpose: To identify and name the kilometer as a measure of distance. To demonstrate the relationship of meters to kilometers. To rename meters as kilometers and kilometers as meters. To read distances in kilometers To add and subtract with kilometers. Vocabulary: kilometer, approximately, tenths, decimal, fraction, equivalent, hundredths, to the nearest unit. Time: 45 minutes Grades: Four, Five and Six. Materials: rulers marked in centimeters and millimeters.	Have students determine the speed limit in their communities in kilometers Have pupils measure room and record the measurement to the nearest 0.5 meter and the nearest 0.01 meter Have pupils measure furniture in the classroom and record measurements in meters. Have pupils make a leaf collection. Ask them to label each leaf and record its length and width in millimeters and in centimeters.

Appendix 11 (continued)

Sample Worksheet

Use what you have learned.

How far are the planets from the sun?



A. Which planet is closest to the sun? Mercury

B. Which planet is farthest from the sun? Pluto

C. How much farther from the sun is Mars than Earth? 80 million km

$$\begin{array}{r} 229 \\ -\ 149 \\ \hline 80 \end{array}$$

D. How much closer to the sun is Venus than Earth? 42 million km

$$\begin{array}{r} 149 \\ -\ 107 \\ \hline 42 \end{array}$$

E. Which planet is closer to the sun— Neptune, Uranus, or Pluto? Uranus

F. How much closer to the sun is Jupiter than Pluto? 5130 million km

$$\begin{array}{r} 5903 \\ -\ 773 \\ \hline 5130 \end{array}$$

METRIC IN-SERVICE WORKSHOP:
LINEAR MEASURE
VOLUME
(Capacity)

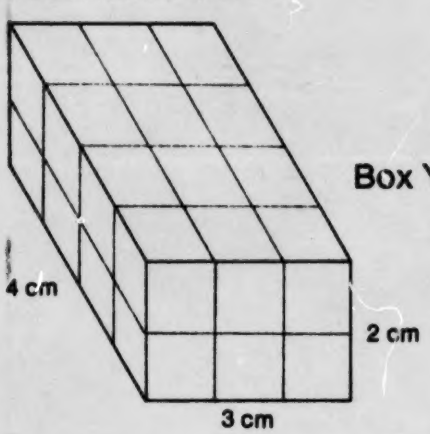
Teacher Training Session	Classroom Demonstration	Activities
Purpose:To demonstrate the cubic centimeter (cm^3) as a unit of volume. To organize a formula for the volume of a rectangular solid. To identify and name the liter (ℓ) as the base unit of capacity To identify objects which have the capacity of 1 liter Time: 1 hour Audience: Teachers, Administrators--number of participants 15-20. Materials: centimeter cubes, boxes,(varied shapes and sizes)	Purpose:To demonstrate the cubic centimeter (cm^3) as a unit of volume. To measure the volume of given models by counting the cubic centimeters in each structure To organize a formula for the volume of a rectangular solid To identify the capacity of a metric cup. Vocabulary: liter,milliliter, metric cup, kiloliter. Time: 45 minutes Grades: Four, Five and Six. Materials: centimeter cubes, boxes(varied shapes and sizes)	Ask pupils to estimate the number of centimeter cubes which would be needed to fill a given box. Then have them check their estimates by filling the box. Have pupils estimate the dimensions of a packing box. Next have them check by measuring the dimensions. Finally, ask them to compute the volume. Have the pupils calibrate a jar by using a tablespoon to fill the jar to levels of 30 milliliters, 60 milliliters, etc. Have them use rubber bands to indicate the measures. Then label the levels with a magic marker. Have the pupils use this jar to determine the number of milliliters that other containers can hold.

Sample Worksheet

Use cubic units to measure volume.

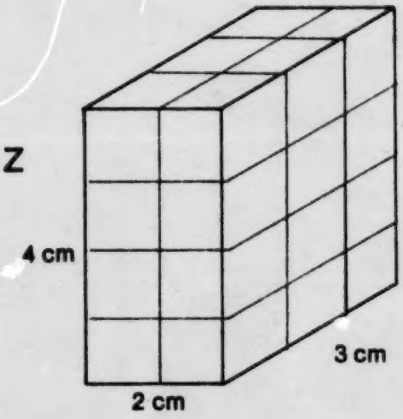
explore

Which box holds more?



Box Y

Box Z



1 Measure box Y. Height 2 cm Width 3 cm Length 4 cm

How many cm^3 in box Y? 24 cm^3

2 Measure box Z. Height 4 cm Width 2 cm Length 3 cm

How many cm^3 in box Z? 24 cm^3

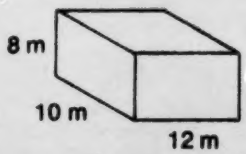
3 Does this rule work? Try it. Volume or Capacity = length × width × height = $unit^3$

Box Y 2 cm × 3 cm × 4 cm = 24 cm^3

Box Z 4 cm × 2 cm × 3 cm = 24 cm^3

4 Find the volume of each container pictured.

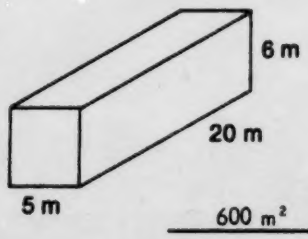
A.



960 m^2

8 m x 10 m x 12 m = 960 cm^2

B.



600 m^2

5 m x 20 m x 6 m = 600 m^2

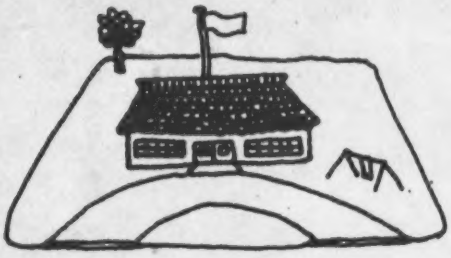
METRIC IN-SERVICE WORKSHOP:
(The Kilometer)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify a Kilometer as a measure of distance. To locate objects on a map by naming intersecting lines. To identify km as the symbol for kilometer. To rename a given number of meters as a number of kilometers. To compare a given number of meters to a given number of kilometers. Time: 1 hour Materials: scale maps. Audience: Teachers, Administrators--number of participants 15-20.	Purpose: To count blocks on a grid to find the distance from one place to another. To use a scale to identify a kilometer on a given map. To use > or < to compare distances given to 1 kilometer. Vocabulary: kilometer, scale map, thousands. Time: 45 minutes Grades: Kindergarten, First Second and Third. Materials: scale maps. trundle wheel	Clock 1 kilometer from school. Take the pupils on a one kilometer walk, having them count steps, houses, street lights, etc. to estimate. If a meter trundle wheel is available, have the pupils use it to measure a kilometer. Have pupils describe something they can do in kilometers, meters, or centimeters. Then have pupils describe something Superman might do in kilometers, meters, or centimeters. Ask pupils to use metric units of length to write a personal experience in word problem form. Then have the pupils exchange papers to solve the problems.

Sample Worksheet

Work with the kilometer.
1000 meters = 1 kilometer

explore



1 A kilometer is about twice the distance around some school yards.

2 We write km for kilometer.

try

1 Make true sentences.

A. 1 km = 1000 m

B. 3000 m = 3 km

C. 2000 m = 2 km

D. 6 km = 6000 m

E. 7 km = 7000 m

F. 4 km = 4000 m

2 Who rode the bike more than 1 kilometer? Ring to show.

A.

965 m

B.

1005 m

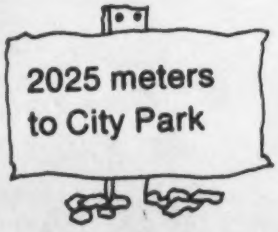
C.

699 m

3 Ring to show less than 2 kilometers.

A.

B.



C.

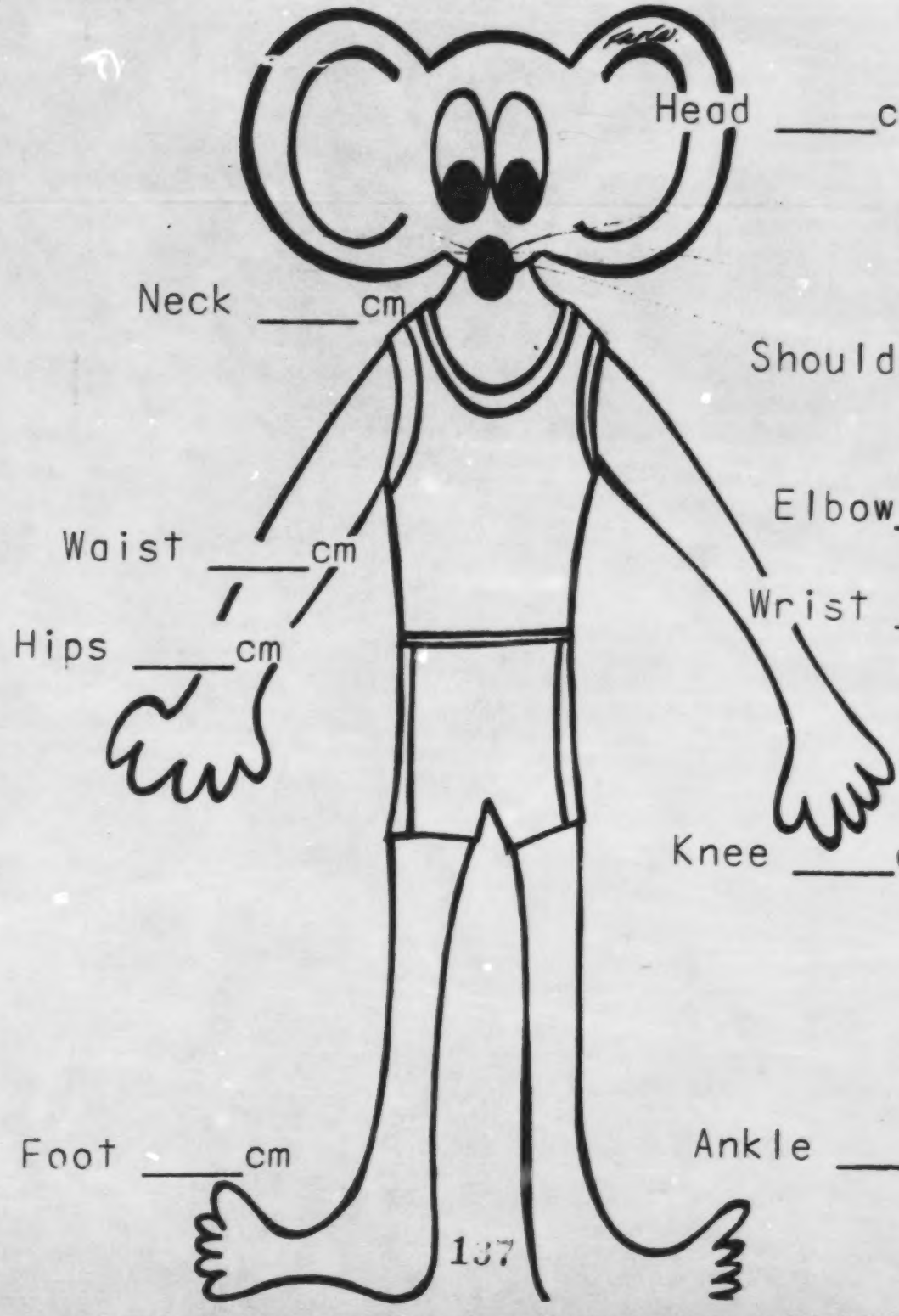
METRIC IN-SERVICE WORKSHOP

(THE CENTIMETER)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify and name a centimeter unit. To estimate and to measure in centimeters. To identify cm as the symbol for centimeter. Time: 1 hour Audience: Teacher, Administrators, --Number of participants: 15-20. Materials: centimeter rulers	Purpose: To identify and name a centimeter unit. To count centimeters on a ruler. To estimate and to measure in centimeters. To identify cm as the symbol for centimeter. Vocabulary: centimeter Time: 45 minutes. Grades: Kindergarten, First, Second and Third. Materials: centimeter rulers	Have students pretend that they manufacture paper products. Have them give the dimensions in the appropriate metric units of paper napkins, towels, and place mats.

Sample Worksheet

BODY MEASUREMENTS



Head _____cm

Neck _____cm

Shoulder ____cm

Elbow_____cm

Waist _____cm

Wrist _____cm

Hips _____cm

Knee _____cm

Foot _____cm

Ankle _____cm

The student will be able to measure objects in metres, centimetres and millimetres.

METRIC IN-SERVICE WORKSHOP:

(The Meter)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To estimate a distance of one meter. To estimate and measure various distances using the meter as the unit of measure. Time: 1 hour Audience: Teachers, Administrators, Curriculum Coordinators--number of participants:15-20. Materials: Meter stick. Vocabulary: estimate, meter, length, width, height, distance.	Purpose: To demonstrate that 1 meter is equal to 100 centimeters and that 100 centimeters equals 1 meter. To identify and nime 1 meter. To identify 1 meter length. To compare given lengths to 1 meter by using >, =, < Vocabulary: estimate, meter, length, width, height, distance Time: 45 minutes. Grades: Kindergarten, First, Second and Third. Materials: meter stick.	Divide pupils into three teams. Give two teams a list of objects tobe measured. Have one team measure in centimeters and the other in meters. Ask each team to list the measurements on the chalkboard. Finally, have the third team read the name of the object and match it to the appropriate measurements Have pupils use meter sticks to measure playground apparatus and markings for games and races. As a class project, pupils can measure each other's height in meters and centimeters. Then have them change their measurements to centimeters and ask them to make a classroom chart which shows the height of each pupil.

Appendix 11 (continued)

Sample Worksheet

The jump rope is 1 meter long.

Color the objects that would measure 1 meter.

One jump is 1 meter long.

Six jumps are _____ meters long in all.

Draw in more bunnies and flowers.

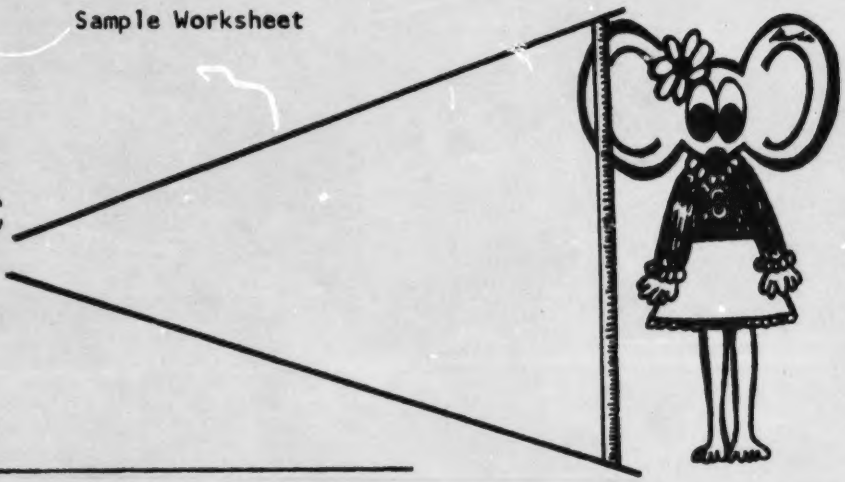
METRIC IN-SERVICE WORKSHOP:

(The Centimeter)

Teacher Training Session	Classroom Demonstration	Activities
Prupose: To identify and name 1 centimeter. To identify objects 1 centimeter long. To use ,and , or to classify pictured objects which are greater, lessthan, or equal to 1 centimeter. To identify cm as the symbol for centimeter. Time: 1 hour Audience: Teachers, Administrators, Curriculum Coordinators--number of participants:15-20. Materials: centimeter rods,and centimeter cubes	Purpose: To count centimeters. To count centimeters on a line calibrated in centimeters. To determine the length of a pictured object by matching it to a line calibrated in centimeters. Vocabulary: Centimeter line (This is a readiness activity for the use of the centimeter ruler.) Time: 45 minutes Grades: Kindergarten, First, Second, Third. Materials: Centimeter rods and centimeter cubes.	Direct pupils to explore the classroom and their belongings to find measurements of 1 centimeter. Have the pupils use a train of centimeter rods to measure classroom objects. Have pupils use centimeter rulers to measure objects which measure 1 cm or longer.

Appendix 11 (continued)

Sample Worksheet



NAME _____

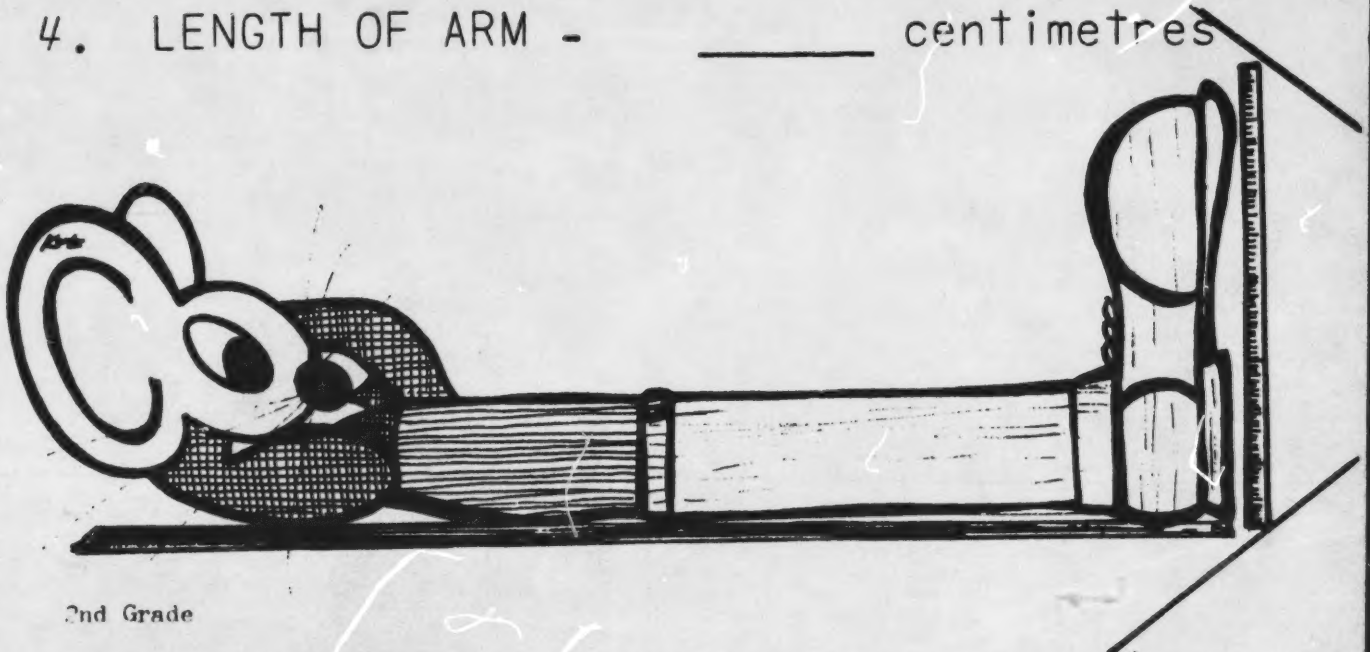
1. HEIGHT - _____ metres

_____ centimetres

2. LENGTH OF SHOE - _____ centimetres

3. WAIST - _____ centimetres

4. LENGTH OF ARM - _____ centimetres



2nd Grade

The student will be able to measure distances in metres to the nearest whole metre.

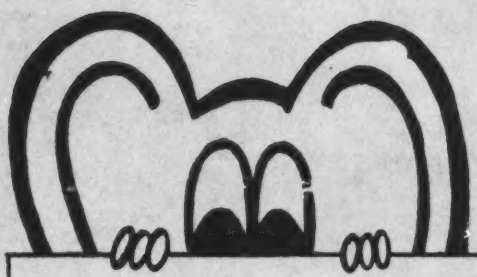
METRIC IN-SERVICE WORKSHOP :

(Appraisal Activity)

Teacher Training Session	Classroom Demonstration	Activities
Purpose: To identify metric units of measurement in the environment. To identify the meter as the basic unit of the metric system. To identify lengths and distance of one meter. Time: 1 hour Audience:Teachers, Administrators, Curriculum Coordinators--number of participants 15-20. Materials: meter stick	Purpose: To identify the millimeter, centimeter,meter, and kilometer as units of length or distance in the metric system. To measure a given object by using a set of congruent units. To measure a given object using two sets of congruent units each different in length. Vocabulary: metric system, meter, unit. Time: 45 minutes Grades:Kindergarten, First Second and Third Materials: crayons, paper clips, string or cord, scissors.	Provide three groups each with a set of units different in length from the other. Have pupils estimate which set would require the most units to measure an object. Which set would require the least? Which might need the same number? Then ask the pupils to measure the object(s) to verify.

Sample Worksheet

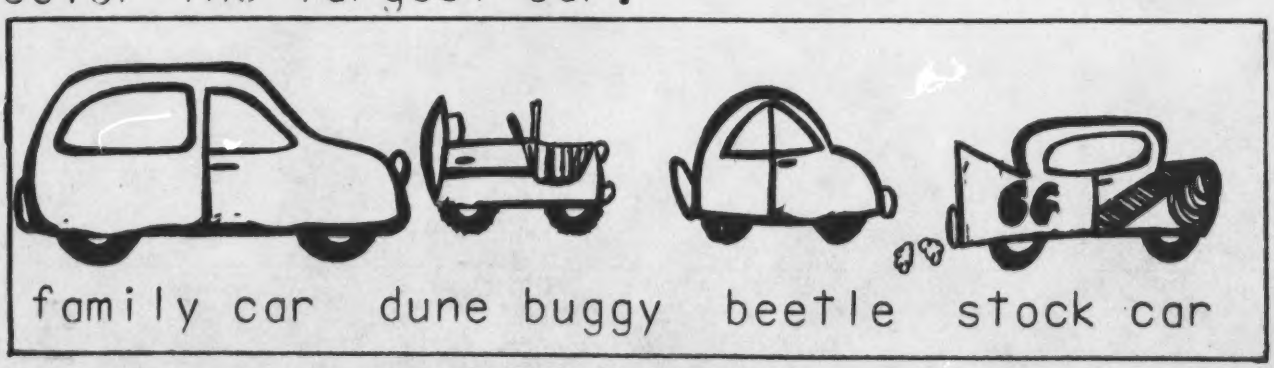
LARGEST



Color the largest mouse.

Color the largest animal.

Color the largest car.



The student will be able to identify which object is longer, shorter, larger, smaller or equal when comparing objects.

HEMPSTEAD PUBLIC SCHOOLS

185 PENINSULA BOULEVARD
HEMPSTEAD, NEW YORK 11550

MEMO TO: Mr. Joseph A. Wright

FROM: Dr. Fred H. Dippel

DATE: June 3, 1978

SUBJECT: Practicum Implementation

Based on communications to me, the program to Implement The Metric System: Grades K-6 has been approved for Jackson Main and Ludlum Elementary Schools during the comming school year.

I will be in touch with you as we get closer to the start of the school year to identify dates, etc.

Have a good summer!

FD/mb